Migrant Adult Learners and Digital Literacy: Using DBR to Support Teaching and Learning

A dissertation

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Dedication

The real engine behind this research is the community of policymakers, administrators, teachers, AmericaCorps members, and volunteers who work to ensure access to digital literacy programming that supports the integration and resettlement of newcomers in our highly technology-based society. They work incredibly hard to buoy the efforts of the adult refugee and immigrant learners they support. Over the course of my twenty years of practitioner experience and five years of doctoral work I have tried to channel this hard work, motivation, and care, to make sure that my interpretation of previous research literature and any contributions I might make to it reflect the voices of this community. I am grateful for their guidance and, so, dedicate this dissertation to them.

Abstract

This research explores the difficulties faced by many migrant, refugee, and immigrant adults confronted with technological ubiquity in economically developed countries. Preparing migrant adult learners for the digital world by building digital literacy skills can help to maintain home language proficiency, support English language learning, and open paths to resources needed to support migration. In the United States, Adult Basic Education (ABE) programs engage in this work, supporting learners through the guidance of teachers trained to integrate digital literacy instruction into language proficiency development. However, because the need is great and the capacity of formal ABE programs to provide service is limited, much instruction happens in community technology labs situated in libraries, public housing facilities, and community based organizations (CBOs). CBOs provide critical educational opportunities; however, the teachers working there, often minimally trained volunteers or national service corps members (i.e., AmeriCorps), struggle to support the learning needs of adults for whom English is not a first language.

This alternative dissertation unfolded in three stages in order to define instructional challenges common in basic computer classes labs and answer this overarching question: What support is needed to help teachers provide quality digital literacy instruction to English language learners who are struggling to resettle and integrate in a technologically rich society? Design Based Research (DBR) was used to collaboratively and iteratively research, define, build, and implement an instructional

intervention while contributing to knowledge regarding issues of digital literacy and language learning.

Three complementary theoretical frameworks guided this research. Meeting the overarching research goal of both investigating and supporting instruction, this study drew heavily on sociocultural view that environmental factors mediate learning. Engeström's (1987; 1999) Activity System model served as an aid to making sense of the impact on instructional strategies and resources in the classroom. Also providing guidance was Systemic Functional Linguistics (SFL) theory of language focusing on functions and meaning of language in social context (Halliday, 1978; Schleppegrell, 2004), which supported the investigation of the language employed in instruction. Finally, this work was motivated by the theoretical perspective that learners' contexts of interaction (in this case, a digital literacy lab), and the interlocutors and their ideologies encountered therein, mediate language and other learning. This post-structuralist view holds that learner identity and language learning, rather than being informed solely by psychological or cognitive constructs, are shaped through interaction and relationships within the larger social world (Norton-Peirce, 1995).

Findings from the three areas of study showed the following: a.) Participant AmeriCorps members over employed teacher-centered large group instruction, which alienated learners and impacted persistence. They, therefore, determined that they needed a digital homeroom to support differentiated instruction and expand learning out of classroom; b.) When the corps members made use of a digital homeroom stocked with relevant learning activities, they relied on the structure afforded by the website to provide the control they perceived as required in their workshops, which in turn provided opportunity for them to observe learner engagement. This ultimately served as motivation for the corps members to further explore and respond to learner needs and created opportunities for differentiated instruction; c.) Knowing a word in the context of basic computer skills workshops included accomplishing a physical embodiment of the skills associated with it, and learners needed multiple exposures and ample practice with both the vocabulary and the skills to progress.

The research demonstrates the value of using DBR as a tool for education research. Through the process of developing a local resource, the participants learned about teaching and created a curriculum, the development of which suggests a shift in Engeström's Activity System model from linear conceptualization with all components shaping the object and the outcomes to an emphasis on the relationship between mediating artifacts and the subject, in addition to the object. Further, the resulting resources, which are in place for future corps member, will serve as an educative curriculum that can mitigate lack of training and prior experience for them. These observations suggest an imperative for engaged researchers working in collaboration with educators in naturalistic settings.

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CHAPTER 1: INTRODUCTION

The students, including six English language learners (ELLs) from East Africa, Southeast Asia, and Central America, trickled into the computer lab, until all of the 20 computers were occupied. The learners had all been referred to the class at their intake session at the nonprofit organization. Several had come seeking housing assistance, two were seeking help finding employment. A few had just heard that there was a computer class. The six English learners possessed diverse levels of English language proficiency. The elderly East African woman who seemed to have the lowest proficiency (she could say hello and ask very basic questions) was also sight-impaired.

The workshop leader, a new volunteer at the community technology lab, greeted everyone as they came in and handed out a seven-page document on the topic of the Internet, the instructional resource on which every minute of the class was to be based. The handout included screenshots of computers, websites, and Internet browsers, along with English text explanations of what would be covered in class, things like opening a browser, elements of browser infrastructure, understanding different types of broadband, and searching the Internet. After a brief personal introduction and preview of the activity of the day, the leader stood at her computer, which was hooked up to a projector, and for 90 minutes talked through the entire handout; the students, expected to click along, did their best. They listened attentively, searched for the screenshots that corresponded to what they saw on the big screen at the front of the room, and tried to follow the required 'clicks' using their own computers.

Though it was evident from the very beginning that not everyone could attend to her instructions or keep pace, could understand her language or see the tiny URLs displayed on the projected screen, the volunteer teacher marched forth, covering each page of the handout and delivering imperatives about when and where to click. I witnessed several of the ELLs try to ask clarifying questions to confirm verbal commands and attempt to recognize the letter names the teacher spelled out in an effort to get everyone one on the same webpage. One elderly Somali woman pressed "G" on her keyboard each time the teacher said "J".

By the end of the ninety minutes, the teacher looked exhausted. Trying to keep the learners on pace with the clicks had taken a great deal of effort. Most did not make it to the final summative scavenger hunt, "the practice part" as the teacher called it, at the end of the lesson. The last twenty minutes of class were reserved for an online assessment based on the content presented. None of the English learners made it past the first few questions of the assessment before they either gave up or time ran out.

(From observation report November 2013)

The frustration I experienced as a participant-observer during the class described above is what motivates this dissertation. I was struck by how hard everyone in the setting was working, how little learning was happening, and what a missed opportunity the entire class represented. In response, the purpose of this dissertation research was to explore current digital literacy instruction available to English language learners (ELLs) attending classes in community technology labs, develop strategies and resources to support volunteers, tutors, and teachers who provide instruction in classes like these, and to reduce instances of what's described above.

There is a definite need to provide digital literacy instruction to newcomers to the United States. The rapid development and adoption of information communication technologies (ICTs) has made more complex and varied the means by which we use language, broadened the pool of interlocutors with whom we interact, and changed how we access information (Blommaert, 2010). A rich and deepening body of scholarship shows that this new reality has great impact on identity, integration, and language use and learning. For migrants with digital access and skills, ICTs mean that leaving home need not mean disconnecting from homeland, or an end to the use of home language (Vertovec, 2007). However, lack of expertise with computers can contribute to isolation and disconnection, and can be a barrier to full participation in civic and work life in their new communities (Jacobson, 2012), the naturalistic setting for my research.

My motivation for this dissertation research stems not only from collective knowledge represented in literature on English language learning, migrant integration, and digital inclusion, but also my previous work as an adult basic education teacher, online curriculum developer, and teacher educator. Through this work, I had the opportunity and the challenge of supporting teachers and learners working together to build the digital literacy skills needed for today's world. A big question loomed while I was doing the work, a question that serves as the foundation for this research: What support is needed to help teachers provide quality digital literacy instruction to learners who are struggling to resettle and integrate in a technologically rich society?

Who are the Learners in the Story?

Adult ELLs often arrive in their countries of residence as refugees or immigrants. In the United States, Adult Basic Education (ABE) programs enrolled 1,535,041learners during program year 2014–15, forty-four percent of whom were studying English language (*Adult education services: The success, the impact and the need*, 2016) The few who engage in educational programming aside from language do so to reach academic and career goals; however, ABE programs serve only a fraction of the total population who do not yet have a high school diploma. The number enrolled in the U.S. represents an estimated ten percent of the 36 million adults who have basic skill needs (OECD, 2013b).

The Adult Basic Education System

Many ELLs in the United States receive English language and literacy instruction through both federal- and state-funded ABE programs, a practice established under the Americanization and Settlement movements in the early 1900s. Policymaking and funding was first consolidated under the U.S. Department of Education with the Adult Basic Education Act of 1966 (Stubblefield & Keane, 1994). The 1990s brought the arrival of more migrants than any previous decade, requiring programs nationwide to meet the literacy needs of ELLs who may have come to the U.S. as refugees with limited or interrupted formal schooling (Wrigley, 2011). Current ABE programming, including English language education, is defined by the *Workforce Investment Act* (1998), Title II (WIA II), and in revised successive legislation called the *Workforce Innovation and Opportunity Act* (2014), Title II (WIOA II). These Acts spell out allowable services and the mechanisms for which funding is provided. Through a collaborative structure, the federal government provides funds to states, which then provide grants to local ABE programs. This partnership is based on ongoing evaluation, conducted through reporting of learner outcomes on testing, employment, and matriculation into post-secondary schooling, proving sound use of federal funding by the states.

The laws have emphasized the importance of state-level agencies for the implementation of ABE programming, describing the work as a "partnership among the Federal Government, States, and localities" (*Workforce Innovation and Opportunity Act*, 2014, Section 202). Through this collaborative structure, the federal government provides funds via the Adult Education and Family Literacy Act (AEFLA) grants to states, which are re-granted to support local ABE programs. The basis for the partnership has always been funding from the federal government and demonstration of sound use of that funding by the states (i.e., state agencies distribute federal funding to local organizations whose implementation aligns with state and federal guidelines). It should be noted that all states are required to minimally match federal funds ($0.25 for every $1.00 of federal money), though many exceed this amount considerably. In Minnesota, for example, in 2010 the state government contributed $43.5 million, far exceeding the federal funding total of $6.16 million (*Minnesota ABE ten year participation and funding trend data: 2000-2010*, 2010).

Learning in Community Technology Labs

CBOs that offer services outside of this system do not receive federal ABE funding (and in many states, little state money, either), so they are not held to federal accountability measures and testing requirements. This has some impact on the quality of programming provided because in many states there are fewer guidelines for implementation. For example, the digital literacy courses in these CBOs are generally not led by trained teachers with structured curricula; rather, they offer limited hours of access to computer labs where learners click through website materials alone, and are removed from contexts where these skills need to be used. The teachers or facilitators who are present are often volunteers or service corps members, who, while highly motivated, likely have very limited prior experience and professional development to support their practice. Lacking developed expertise and a professional community, they struggle to support the wide range of learning needs of the learners who visit their labs.

The CBOs tend to offer programming that represents goals articulated in their mission statements rather than the actual participants' goals (job search, career development, housing assistance, etc.) (Jacobson, 2012). However, Eubanks (2011) wrote, in *Digital Deadend,* that locating these labs in places where participants receive other services creates opportunities for "connecting goals of technology access and community building" (p. 165). Additionally, the CBOs fill an informal learning niche, where learners can attend without formal enrollment, attendance, or testing requirements present in formal ABE programs. Regardless of where labs are located, the issue is the quality of instruction and impact on learner engagement and persistence and their eventual use of digital technologies in daily life.

The Digital Divide

The learners described in the story are on the wrong side of the digital divide. They are unlikely to have access to a computer or Internet at home, and if they do, they may struggle knowing how, or for what purpose, to use it. There are several interpretations of what constitutes the digital divide, ranging in definition from lack of access to computers and the internet to lack of ability to access information using these tools (Eubanks, 2011; Jacobson, 2012; Wei & Hindman, 2011). Access does play a part; immigrants and other adults with basic skill needs are less likely to have access to a computer and/or Internet at home than others residing in wealthy English speaking countries (Chiswick & Miller, 2007; Ono & Zavodny, 2007; Stites, 2004).

However, more recent research and data show how quickly the landscape is changing. Access is no longer the primary measure of the digital divide, because in-home access to the Internet has increased dramatically over the past few years. The National Telecommunications and Information Administration of the U.S. Department of Commerce reports that residential use of broadband (high-speed) Internet is rapidly rising. Results from a 2012 survey showed broadband adoption to be increasing for both low-income households and minorities, defined as African American, Hispanic, and "other." For example, within the categories of low-income and Hispanic Americans there was significant in-home access to the Internet (43% and 59%, respectively) ("Connected Nation: Residential broadband adoption survey," 2012). Additionally, a recent Pew Center for Research study showed that even as home broadband access had plateaued, use of mobile broadband through smartphones is increasing (Horrigan & Duggan, 2015). While there is a rising increase in access, the new huge divide is between those who know how to use the Internet to access information and those who do not. Digital literacy is now defined not by simple technical skills, but rather these skills plus attitudes and understanding of how to access and communicate information and knowledge (Bawden, 2008). One's ability to do so is now a measure of the digital divide. Wei and Hindman (2011) called it the "usage gap" between those who could effectively use new information and communication tools, such as the Internet, and those who could not (p. 218). This definition and the stark depiction of learners struggling to get to the other side of the digital divide requires an understanding of how the ability to access information is changing the way we think about literacy.

Technology and Digital Literacies

Technology and the type and quantity of information on the Internet are changing the way technology is used for learning, and the way we read and learn (Lesgold & Welch-Ross, 2012; Sutherland-Smith, 2002; Wei & Hindman, 2011). One might say that technology has changed our definition of literacy, expanding it to include much more than comprehension of text. Lesgold and Welch-Ross (2012) argued that that being literate requires proficiency with the tools and practices to accomplish tasks valued by society that require reading and writing. Sutherland-Smith (2002) described how new technologies have redefined literacy to include digital and information literacies, even for ELLs. She found that reading done via the Internet as Web literacy, a non-linear approach to literacy combining both reading and Internet navigation skills: "finding, scanning, digesting, and storing Internet information" (p. 663). Sutherland-Smith's (2002) research revealed that the Internet presents nearly infinite choices for accessing information; therefore, she suggested that Web literacy requires higher-order thinking than reading paper-based, linear texts because it is interactive, requires visual literacy, employs non-sequential reading strategies, and blurs the distinction between reader and writer.

To better understand the impact of technology on learners' lives and how to best support its use in education, teachers should have an understanding of what is meant by "digital literacy," sometimes described as the different "literacies" required for proficient digital technology use. These proficiencies have been described as "New Literacies," a term that first appeared in the research of David Buckingham in 1993. Buckingham argued that technologies like CD-ROM and video games created new contexts for interacting with text, and that they thus expanded rather than decreased literacy activities, as had been suggested by critics at the time (Lankshear & Knobel, 2013). Buckingham (1993) suggested that new technologies were representative of their larger social environment and attendant social processes, and that their development required competencies similar to print literacy skills. These New Literacies, he suggested, were as much a literate practice as those occurring through interactions with traditional text. It is worth drawing attention to the plural aspect of the term "literacies," which suggests our contemporary conceptualization of such skills to be multiple. The "literacies" drawn upon when communicating with someone; searching for, evaluating, or making use of information; or engaging digital technology for daily tasks include a range of skills or literacies.

A few key literacies are drawn upon when reading online. Photo-visual literacy is proficiency in reading for meaning of shapes and symbols, which makes it possible to anticipate the action initiated by clicking on an icon in a digital environment (Jones-Kavalier & Flannigan, 2006). Lateral (hypermedia) literacy, in contrast to the linear literacy more commonly required when reading print on paper, is a non-linear means by which one can access information. An example of this is knowing that clicking on text highlighted by a color-formatted font will take you to a new website or page, video, or some other piece of digital information (Eshet-Alkalai, 2004; Jones-Kavalier & Flannigan, 2006). Similarly, production of text has evolved beyond simple writing skills; reproduction literacy supports editing digital texts and images to create original works (Eshet-Alkalai, 2004; Jones-Kavalier & Flannigan, 2006). This is also known as remix (Markham, 2013).

Beyond the way we read, the quantity of digital technologies present in our society also demands applying computer skills to solve problems or sustain connections. Network literacy involves learning about creating personal networks as well as learning through them, accessing information, and producing and distributing information through the network, a much-needed skill given the predominance of online social networking (Pegrum, 2010). Network literacy is knowing how to build and sustain digital social networks, and make use of them for different tasks (e.g., LinkedIn for work and perhaps Facebook for friends and family). Information literacy requires making use of multimedia technology to find, evaluate, make use of, and share information using digital technologies (Lankshear & Knobel, 2013).

Another view of this "literacy" was developed by the Organization of Economic Cooperation and Development (OECD) for the 2012 Program for International Assessment of Adult Competencies Survey of Adult Skills[1] (PIAAC), which assessed adults in participating countries on key skills needed for successful participation in technologically-rich work and daily life (OECD, 2013a). The relevant assessment here is Problem Solving in Technology-Rich Environments (PS-TRE), which elucidates components of problem-solving, including determining what is required by a task, planning a process for solving the problem, and selecting relevant technology resources.

The assessment showed that an alarmingly high percentage of adults in the U.S. lack both the technology proficiency and cognitive skills necessary to leverage use of

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[1] The PIAAC surveys were first given to nearly 166,000 adults aged 16-65 in 24 countries in 2012 and measured literacy, numeracy, and problem solving in technology-rich environments (PS-TRE) (OECD, 2013a).

technologies like spreadsheets, Internet search, email, and social media to solve real-world problems encountered in work, school, and daily life (OECD, 2013a; Rampey et al., 2016). Arguably, proficiency throughout these literacies supports full participation in many aspects of daily life in the U.S.

These new interpretations expand literacy beyond decoding and encoding text toward a sociocultural view of literacy that requires an emphasis on purpose and context, frequently the context of the Internet (Gee, 2010). This puts new demands on students and the programs that provide services for them. Sutherland-Smith (2002) believes, "If people cannot undertake this knowledge-enrichment process they are disadvantaged and the education system has failed to give them adequate literacy skills" (p. 662). My premise in this dissertation is that teachers, no matter their instructional setting, need to be prepared to meet learners where they are with respect to these "literacies." For some learners, that will mean teaching very basic skills like mousing and keyboard control. Others will be able to apply these skills to more sophisticated tasks like creating a Word document or writing an email, but will need support with contextualized use in problem-solving required to do things like write a resume, find a job, or even learn about how to make changes to immigration status.

Impact on ELLs in the U.S.

This shift in literacies impacts immigrants and refugee ELLs in the U.S. and other technologically rich countries. However, there is tension about how to describe this impact. One perspective is that increasing access to the Internet and the information found there will enable adult immigrants and refugees access to the prosperity enjoyed by white, middle class Americans (McCain, 2009; Moriarty, 2011; Stites, 2004). The second perspective positions technology as a gatekeeper that has the potential to compound inequity and reinforce barriers to success that already exist because of the potential for resources to be concentrated in areas of privilege (Darvin & Norton, 2015; Eubanks, 2011; Mutonyi & Norton, 2007; Rodino-Colocino, 2006; Venkant, 2001). What is true is that the difference between low and high socio-economic classes in use of the Internet for accessing information has never been greater (Wei & Hindman, 2011). At the same time, use of communication information technologies at work is a new norm; a 2008 Pew study showed that only 13% of Americans do not use the internet (Anderson & Perrin, 2016), and that digital literacy skills are key to success in post-secondary schooling (Marchwick, Johnson, & Parrish, 2008; McCain, 2009; Moriarty, 2011; Jacobson, 2012).

It seems that no matter the motivation, whether it is to help learners leverage the power of technology to overcome barriers or to mitigate the negative impact of technology on their lives, there is a need for digital literacy programming in both formal and informal contexts. McCain (2009) calls this a new reality. She writes,

> New structures and processes must be developed to accommodate the new reality: Individuals should be able to access knowledge, skills, and information not only by using multiple media at any time or place, but in different formats, structures, and quantities, and for different personally determined purposes. (p. 19)

Furthermore, successful programming requires providing adequate support for learners as they engage in activities that embed digital literacy instruction into relevant and motivating contexts[2] (Eubanks, 2011; Moriarty, 2011; Norton, 2013; Reder, Vanek, & Wrigley, 2012; Silver-Pacuilla & Reder, 2008). Jacobson (2012) notes that this approach is often lacking in community technology labs due to lack of resources and trained staff.

Contributions of this Dissertation

Preparing migrant adult learners for the digital world by building digital literacy skills can help to maintain home language proficiency, support English language learning, and open paths to resources needed to support migration or resettlement. In the United States, Adult Basic Education (ABE) programs endeavor in this work, supporting learners through the guidance of teachers trained to integrate digital literacy instruction into language proficiency development. However, because the need is great and the capacity of formal ABE programs to provide services is limited, much digital literacy instruction happens in informal community technology labs situated in libraries, public housing facilities, and community based organizations (CBOs), often staffed by

[2] Many approved ABE programs embed digital literacy instruction into regular classes rather than offering stand-alone technology skills instruction; research suggests integration of instruction best prepares learners for actual independent use of technology (Jacobson, 2012; Moriarty, 2011; Stites, 2004).

minimally trained volunteers or national service corps members, as in the example shared at the beginning of this chapter.

Prior research provides guidance for creating and delivering educational services to adult migrant learners (e.g., Condelli & Wrigley, 2009, on instructional strategies that work well with adult ESL students; Harris, 2015, on technology integration in adult ESL classes), but most fall short of elucidating how to mitigate the particular instructional challenges posed in these informal learning contexts. Research on adult ESL and academic language instruction sets forth parameters for contextualized and communicative pedagogy; literature from the field of instructional design provides guidance on construction of instructive web-based materials; and educational technology research describes strategies supporting effective integration of technology into instruction. However, more research that deals specifically with instructional strategies best suited to support this audience of adult learners who participate in settings with untrained teachers is needed, especially research that puts forth strategies for making learning environments and the instruction provided therein more beneficial for these adult migrant learners. Such research can add to disciplinary knowledge in the areas of digital literacy instruction and language learning.

A Study in Three Parts

This dissertation addresses practical problems faced by AmeriCorps members who facilitate digital literacy instruction in CBOs by defining instructional challenges and then collaboratively building and implementing a web-based intervention that scaffolds their instruction, including a response to the linguistic demands of digital literacy learning. This dissertation is structured in three studies which describe the development of the intervention resource, and by its development, shed light on the means by which CBOs can support learners. The phases are as follows:

1) the exploratory phase, consisting of a pilot study on learner identity and digital literacy which elucidated instructional challenges, and a subsequent case study exploring the issue from the teachers' perspectives
2) a design study that led to the creation of instructional resources
3) a study exploring the impact of language in digital literacy instruction.

These phases fit together as a complete meso-cycle of Educational Design Research (EDR), defined by McKenney & Reeves (2012) as a series of studies that work toward developing an understanding of a local instructional challenge, and then work collaboratively with practitioners impacted by that challenge to design and construct a solution, and then evaluate its efficacy. Further, they point to its role in developing theory:

> a genre of research in which the iterative development of solutions to practical and complex educational problems also provides the context for empirical investigation, which yields theoretical understanding that can inform the work of others. (p. 7)

Design Based Research (DBR) is collaborative, informed by and aligned closely with the needs and priorities of participating stakeholders to ensure the relevance of the process and the resulting intervention (Brown, 1992; Cobb, Confrey, diSessa, Lehrer, & Schauble, 2003; Wang & Hannafin, 2005). In addition to being collaborative, it is iterative and has both far and near relevance, solving a local problem and, in the process, arriving at theoretical conclusions. Theoretically, this DBR dissertation research contributes to disciplinary knowledge in the areas of digital literacy instruction and the English language proficiency required for it. The project thus simultaneously strives to solve a local problem while it contributes more generally to learning theories in order to support the extension of findings to similar educational contexts.

Study One: Defining Instructional Challenges through Analysis and Exploration

This first study is a significant part of the analysis and exploration phase of EDR recommended by McKinney and Reeves (2012) "to shape a better understanding of the problem to be addressed" (p. 85). It included multiple data collection activities, which provided information about the practice and beliefs of the participant facilitators at that time. It included and built on a pilot investigation that explored the experience of adult ELLs working to build digital literacy skills in volunteer-led technology labs housed in a CBO.

The pilot study focused on learner experience through a poststructuralist lens of identity and investment (Norton, 2013) and identified the potential negative effects of poorly trained lab volunteers using culturally-bound materials, visually confusing websites, and teacher-centered pedagogy, suggesting the need for adjustments in programming to better support learner persistence. This motivated a second case study, called Study 1 in the dissertation, which shifted to a sociocultural lens (Engeström, 1999) and was undertaken to learn the what the instructors in such settings identify as instructional challenges.

Both studies in the exploratory phase are qualitative case studies. In the pilot, I employed classroom observation, analysis of class materials, and interviews with learners and the teacher. Data drawn from these sources informed findings about what learners privileged as learning investment and elucidated challenges to their learning that potentially served as barriers to reaching their articulated goals. In Study 1, I employed focus groups and observation of the facilitators' instruction to develop a better understanding of their instructional challenges. Data drawn from focus group discussions where the facilitators share their beliefs about instructional challenges are measured against the findings from the pilot study and inform the scope and focus of the intended intervention. The goal of this specific study was to confirm the need to scaffold facilitators' preferred instructional strategies and to better understand where their pre-intervention knowledge and strengths lie. Findings indicate the extent to which an intervention will need to focus on providing support in the following areas: digital literacy and English language content, pedagogical considerations, and tools or technologies to employ in instruction. The exploration to reach this end is guided by the following questions:

1. What potential barriers to learning exist for ELLs in digital literacy classes?

2. What do the participating facilitators suggest are instructional challenges they face when working with adult ELLs in digital literacy classes?
3. What resources do the participating facilitators suggest might be helpful for mitigating articulated challenges as untrained instructors?

The goal of answering these questions was to confirm an initial conjecture about the need for resources and strategies to improve instructional experience for both the facilitators and the learners in their labs and workshops and to begin to understand how the intervention will to take shape. This study included an analysis of the collected data and findings done to confirm or disprove assumptions made in the pilot study, the first phase of the exploration and analysis, which first indicated the need for an intervention. The data reflected a lack of pedagogical knowledge about supporting ELLs in digital literacy and a lack of content and pedagogical knowledge regarding English language instruction.

Study Two: Design and Construction of an Instructional Resource

In this phase of the research, a resource was built to mitigate instructional challenges articulated in the Pilot study and Study 1. The intervention's purpose is to mitigate a potential lack of support caused by the inexperience and lack of training of the facilitators by lowering technology demands complicating learning for migrant adults. This work was guided by a framework for action, Silver-Pacuilla & Reder's (2008) research on the skills threshold required for success with learning through online technologies (described in Chapter 2).

The initial goal for Study 2 was the completion of an intervention, observation of its implementation, and an evaluation of it. Upon completion of this study, early conjectures made about design, available affordances, and materials selection were confirmed or contested, and information supporting the revision of the resource was compiled. The elements of the resulting intervention and articulated design conjectures were informed by previous research in the following areas: academic English and content-based instruction (Arias & Faltis, 2013; Schleppegrill, 2004), usability issues in online environments (Gaver, 1991; Kirschner, Strijbos, Kreijns, & Beers, 2004), and content and pedagogical considerations regarding materials selection (Mishra & Koehler, 2006; Tomlinson, 2012). Applying the findings of research in these areas supported the construction of an intervention characterized by clear layout, intuitiveness of affordances, direct and descriptive language, and culturally accessible resources.

In order to simultaneously build the intervention described above and build knowledge on how to best support ELLs in such a learning environment, careful attention was paid to laying out and documenting the intervention design process. Sandoval's (2014) conjecture mapping model served as the tool for this work. Sandoval (2014) defines design conjectures as "the ideas a research team has about how embodied elements of the design generate mediating processes [observable interactions and artifacts]" (p. 22). These design conjectures guide evaluation of an intervention and shape the focus of the observation to answer the following questions.

1. What characteristics of the intervention, made visible during the design process, are identified by TAC members as supporting their instruction?
2. What learner needs become most salient to novice teachers working in predominantly English language settings as they design and implement strategies and resources for digital literacy instruction for diverse student audiences?

This is research through design, rather than research on design, so though a tangible project of the study is an intervention resource designed to support instruction, the theoretical goal of the study was to better understand the impact of the development process on the AmeriCorps member participants and their instruction.

Study Three: Academic Language of Computer Basics Classes

The third study of the dissertation project was an analysis of the academic language of a digital literacy classroom, which informed the intervention design and instruction in the classrooms. The problem motivating this study emerged in the previously described pilot study, and is illustrated by the story at the beginning of this chapter, showing a pattern of instructional language not accessible to ELLs. The primary goal of this phase of exploration and analysis was to come to an understanding of key features of the academic language of digital literacy by listening to how the focal participants report attending to language and conducting an analysis of language used in the curriculum and instruction of digital literacy. The knowledge gained supported the intervention, ensuring that the language of recommended instructional strategies and materials was clearly written or depicted through pictures, minimizing the need for support with comprehension, and that adequate support with vocabulary was provided when needed. This knowledge was gleaned through analysis of the data guided by the following questions.

1) What are the particular lexical structures (i.e., vocabulary) evident in classroom discourse of digital literacy?
2) How do corps members draw on key vocabulary in their instruction?

To account for the lexical and structural items and their associated meanings in a digital literacy register, I analyzed recordings of classroom observations, instructional materials, and focus group data that included participants describing their beliefs about the role of explicit language instruction in the classroom and the relationship between English language proficiency and digital skill development. This data, combined with samples taken from classroom observation data and field notes, resulted in a better understanding of the language of digital literacy evident in these classrooms. The resulting contribution to the final intervention included a section of the website devoted to vocabulary development, inclusion of language instruction and practice before or in tandem with digital literacy skill instruction, and an awareness of the impact of limited English proficiency on computer skills development in these settings.

Significance of the Study and Timeline

Though my dissertation includes three discrete studies, they are all part of one Education Design Research project intent on solving the problem of barriers of ELL success in digital literacy programming. The timeline for the studies, and future work, is mapped out in Table 1.1 below.

Table 1.1

Study timeline and activities

Study	Dates	Activities	Impact
Pilot Study	Nov. 2013 - May 2014	Investigation of learner experience in community technology lab	Brought to light key instructional challenges for exploration in future studies
Study One	March 2016 - May 2016	Investigation of facilitator beliefs and practices; definition of instructional challenges	Informed creation of the intervention resource(s) by addressing instructional challenges
Study Two	June 2016 - December 2016	Iterative development of intervention resource(s)	Production of intervention resource(s) and knowledge on support of ELLs in digital literacy instruction
Study Three	March 2016 – December 2016	Functional analysis of language used for computer basics instruction	Informed creation of the resource(s) by identifying discourse required to acquire and communicate computer skills

This work began with a pilot study exploring the learner experience in a community technology lab digital literacy class. The instructional challenges that complicated learning for the ELLs in the pilot begged further analysis. Though I suspected they were issues common in similar community settings, a broader study with a focus on instruction was needed. Hence the dissertation, which took those findings and developed knowledge on supporting ELLs in such settings. DBR is a longitudinal approach to research; essentially, the more opportunities there are to test a resource, the more one knows about teaching and learning. Therefore, I see this as the beginning of this inquiry, one that crystalizes relevant instructional issues and puts forth a possible solution for further testing.

CHAPTER 2: METHODOLOGY

In this Chapter, I describe Design Based Research (DBR), the methodology that unites the three studies in the dissertation. I first provide a rationale for using DBR by articulating the theoretical framework on which the whole dissertation rests; sociocultural theory (Engeström, 1987; Vygotsky, 1978). I then present a thorough description of DBR and present examples of DBR research in prior relevant research. Next, I describe the DBR approach used in the dissertation. Finally, I describe the settings and participants of the studies: the community technology labs involved in my study and the Technology Access Collaborative (TAC) AmeriCorps members

DBR in Educational Research

DBR is an approach to education research based on iterative development of an intervention designed to addresses a local challenge; lessons learned during the process of development inform education theory more broadly. McKenney and Reeves (2012) list the following defining characteristics of this genre of research:

> …adaptive, collaborative, contextual, flexible, goal-oriented, grounded, integrative, interactive, interventionist, iterative, methodologically inclusive, multilevel, pragmatic, process-focused, theoretical, transformative, and utility oriented. (p. 13)

Anderson and Shattuck (2012) define DBR as a methodology "that seeks to increase the impact, transfer, and translation of education research into improved practice [and] stresses the need for theory building and the development of design principles that guide, inform, and improve both practice and research" (p. 16). This definition is derived from and evolved from previous conceptualizations of the methodology put forth since the genre of design experimentation research first appeared in the early 1990s.

Origins of DBR

Sandoval and Bell (2004) wrote that DBR is interdisciplinary.

> On the research side of the endeavor, design-based researchers draw from multiple disciplines, including developmental psychology, cognitive science, learning sciences, anthropology, and sociology. On the design side of the work, researchers draw from the fields of computer science, curriculum theory, instructional design, and teacher education. (p. 200)

The seminal works of two scholars, Ann Brown (1992) and Collins (1992) have served as a foundation for subsequent references to DBR in education research literature. Each emphasized aspects of the methodology evident in modern work, but differed according to their motivation for experimental design research and their disciplinary perspectives; Brown's background was in psychology and Collins early influences were drawn from design sciences (Sandoval & Bell, 2004). Both were concerned about theorizing in education research. Brown wrote that design research could increase the relevance of theory because it was contextualized in real educational environments. Collins wrote of the potential for design research in education to bridge the practitioner-researcher gap, by giving voice to teaching practices in formation of theories of learning (Collins, 1992).

Collins' (1992) contribution to current approaches in DBR was his attention to design and a very experimental process for arriving at a theory. Bell (2004) labeled this mode of DBR *cognitive science design-based research*, done to explore cognition and learning. Collins (1992) wrote that he was critical of early design experiments, which he felt were weak because they were carried out by developers of the learning technologies being tested (developers who had vested interest in seeing them succeed) and did not adequately connect design study to theories of learning, yet, it should be noted that he went on to conduct similarly embedded research studies. Collins presented the following characteristics required for design research capable of developing a design theory for educational technology:

1. Participation of teachers as co-investigators,
2. Comparison of multiple interventions,
3. Objective evaluation done by inclusion of comparison interventions and distancing developers from evaluation activities,
4. Testing technologies most likely to succeed first,
5. Ensuring a diversity in the design expertise of research team,
6. Systematic comparison of variables within a site in order to test hypotheses about design,
7. Responsive and flexible redesign during study, and
8. Multiple of valuation tools measuring success and failure (p. 5).

Sandoval and Bell (2004) characterized this contribution as an understanding that effective educational research should mirror design science by determining effectiveness of designed elements by testing different options systematically.

Ann Brown's work in 1990s was motivated by her desire to bridge two contrasting views quality of educational research. On one hand, she recognized the limits of traditional, strictly controlled and lab-based educational psychology research to make real contributions to education practice that occurred in naturalistic settings. On the other hand, she wished to mitigate criticism that work done in naturalistic settings was not scientific enough to be credible (Brown, 1992; Sandoval & Bell, 2004).

Bell (2004) characterized her work as *developmental psychology design-based research* done to better understand both developmental phenomena and conditions required to promote them. In her seminal DBR paper, Brown (1992) described how she had transitioned from work as a psychologist studying memory in controlled settings to a learning scientist working in real educational environments developing education theory and creating interventions useful to classroom teachers. Brown's trajectory reflected a shift in characterization of learning as a social endeavor rather than a strictly cognitive task (Brown, 1992). Prior to this shift it was thought that studying active memory development would provide solutions to solving problems of inert knowledge (acquired facts not readily accessed and applied) and passive learning (lack of self-directed action on the part of students). Brown described previous studies as problematic because of limitations transferring knowledge gleaned from artificial decontextualized lab-based experimental environments to strategic learning strategies effective in the classroom. Brown, hence, shifted from decontextualized studies of memory to case studies and development of instructional strategies, including reciprocal teaching and strategic reading done to elucidate reading comprehension and monitoring strategies of students.

Brown (1992) acknowledged the positive contributions of an idiographic approach to research and qualitative methodology. However, her work maintained the markings of a clinical approach. Like Collins', Brown's brand of design research DBR carried with it a controlled experimental approach where researchers "systemically adjust various aspects of the designed context so that each adjustment served as a type of experimentation that allowed the researchers to test and generate theory in naturalistic contexts" (Barab & Squire, 2004, p. 2). This clinical approach is also reflected in her naming the approach "design experimentation", an implied positivist approach to research requiring formal controls (Sandoval & Bell, 2004). Nonetheless, Brown's work contributed the importance of research in classroom contexts.

The work of these two researchers laid a foundation on which research since have employed to inform their own design research. I appreciate the motivations of each, Brown's desire to develop a methodology that would lend validity to findings of research done in naturalistic settings, and Collins' mirroring of the design process of the engineering world. My work differs from both in one respect; it is not intentional experimental. Other than supporting the introduction of suggested resources along the way, I made no attempt to control for variables in the instructional setting. In this way, my qualitative approach in DBR is more interpretative than positivist.

Definition of Key DBR Features

Though different scholars have favored different approaches to conducting DBR (e.g., McKinney and Reeves' [2009] structural approach focusing on the process of resource development or Sandoval's [2014] use of conjecture in support of theory generation), the literature consistently identifies particular features of DBR. A short description of these features follows, along with brief comments about how they are each relevant to this study.

Contextualized research. The designation of naturalistic context varies in DBR and is bounded depending on the goals of the research, but naturalistic context in some form is necessary for developing theory about teaching and learning that is applicable in naturalistic educational settings, as opposed to knowledge of isolated variables tested in non-participatory or controlled, laboratory contexts (Barab & Squire, 2004). This feature is reflected in much exemplar DBR literature (e.g., Anderson & Shattuck, 2012; Barab & Squire, 2004; Cobb, Confrey, DiSessa, Lehrer, & Schauble, 2003; McKenney & Reeves, 2012; Wang & Hannafin, 2005). Anderson and Shattuck (2012) wrote that contextualization strengthens the validity of education research, and "ensures that the results can be effectively used to assess, inform, and improve practice in at least this one (and likely other) contexts" (p.1). Similarly, a real-world context makes it possible to investigate knowledge about learning through the process of developing interventions to real problems in real context (Barab & Squire, 2004). Hence, DBR does "real work in practical educational contexts" (Cobb et al., 2003, p. 13). As such, DBR is a practical endeavor.

Unfortunately, there has been very little prior research in the context of community-based technology labs, and because the teachers in these labs are often not formally trained, it is difficult to transfer what little research has been done on adult digital literacy and use of online technologies for learning to these community-based technology labs. This dissertation is a multisite study which attempts to fill this gap in knowledge by investigating how individual and context informs teaching and learning in computer labs facilitated the TAC members.

Problem-based interventions. In DBR, the focus of design and research is an observed need or problem defined by literature, existing theory, and observations from naturalistic contexts (Anderson & Shattuck, 2012; Cobb et al., 2003; McKenney & Reeves, 2012). An intervention is initiated by applying previous knowledge and theory to frame and shape a design that can mitigate an identified problem (McKenney & Reeves, 2012). Through this work, knowledge is generated more broadly about aspects of teaching and learning that figure into the problem and developed intervention. McKenney and Reeves (2012) suggest this can happen in two different ways: research *through* intervention or research *on* intervention. Research *through* intervention entails "inquiry focused on understanding the responses the intervention engenders" (p. 23) where the intervention is a means by which to better understand a chosen educational issue and resulting findings contribute to broader theoretical knowledge on “teaching, learning and design” (p. 23). In contrast, research *on* interventions specifically explores “characteristics and functions of particular intervention types” (p. 24) and how those characteristics support educational goals under examination. This view analyzes how design ideas are embodied in an intervention, and findings support knowledge of how curriculum and instructional tools tested can be used in other settings. My study is primarily research *through* design. The process of articulating problem and building an intervention elucidated TAC members’ beliefs about teaching at the start of the project and also hints at knowledge required to support their professional development and the instruction they provide, and, consequently, positively impact learning in community technology labs.

Iterative. DBR requires a longitudinal study of the iterative development of an intervention, indeed many studies have been underway for over a decade (e.g., River City MUVE as described by Clarke & Dede, 2009 and the reciprocal reading strategies from Brown, 1992). This iterative process is constituted by cycles of intervention and revision, testing, and re(design) where continuous synergy between practice and research supports the development of both useful design and theory (Anderson & Shattuck, 2012; Cobb et al., 2003; Wang & Hannafin, 2005).

Cobb et al. (2003) suggests that a primary goal for such research is to build on initial design “by testing and revising conjectures as informed by ongoing analysis of both the students’ reasoning and the learning environment” (p. 11). In this way, iterations act as a form experimental variation. Hence a cycle of conjecture development, intervention building and testing, and reflection make it possible for determinations about learning in one iteration to be used as the focus of inquiry in the next. This flexible and iterative approach to developing an instructional intervention is based on a prioritization of a guiding theoretical framework (Wang & Hannafin, 2005), which may itself be adjusted as the study progresses[3]. As revisions are made to the intervention, a better understanding of the theoretical framework as it plays out in the context becomes evident, and clear documentation of this process supports its replication in other contexts (Anderson & Shattuck, 2012; Sandoval & Bell, 2004; Sandoval, 2014). I view my dissertation work, and the pilot that informed it, as constituting the early stages of future inquiry, the exploratory phase that defined the initial challenge and the first attempt to respond to the challenge through design and construction of a resource. Future studies

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[3] In the case of my study, I started with a poststructural theoretical framework, using Norton's alternative second language acquisition theory of identity, investment, and imagined communities (Norton-Peirce, 1995; Norton, 2013) to understand the issue from the learner's perspective. I then shifted to a sociocultural lens to explore the impact of instructional materials and strategies from the teacher's point of view. I imagine returning to a poststructural lens in future studies investigating the impact of the designed resources on learner investments in digital literacy development.

will further refine the intervention resources and build on findings from this study to develop knowledge about how to support teachers in similar contexts.

Collaborative. That DBR is context-embedded and conducted to address a local problem means that it is enhanced by positive collaboration with the practitioners it supports. In DBR participants are not just research subjects, but actively participate in design and perhaps the analysis (Barab & Squire, 2004). Healthy collaboration begins with finding the problem and continues throughout the research process: reviewing the literature, designing and building the intervention, using and testing it, theorizing about how the intervention solves the problem and what it says about education, and creation of dissemination materials (T. Anderson & Shattuck, 2012; Cobb et al., 2003; S. McKenney & Reeves, 2012; Wang & Hannafin, 2005). Purposeful communication between the researcher(s) and practioner(s) ensures that the knowledge base of both figure into each stage of the DBR process and the iteration is appropriate to the context and, perhaps, sustainable beyond the tenure of the researchers (Anderson & Shattuck, 2012).

The ideal quality and shape of the collaboration is variable depending on the context. In my work, close collaboration between the participant TAC members and me, the researcher, was evident throughout the analysis and exploration phase, through the design and construction phase (with the participants taking the lead in building the intervention) and into the evaluation and reflection phase conducted through several focus groups conversations. I believe this high degree of collaboration across the project better supports the utility of the designed intervention and bodes well for its sustainability.

Outcomes driven: building theory by attending to local utility. McKenney and Reeves (2012) suggest that results from education research need to be both relevant and robust. To be relevant, research must contribute to the knowledge more broadly and result in practical solutions for the educational context in question. To be robust, results must describe not only what works but how and why so that others can use them to inform own work. Consequently, the goals of the research go beyond a local context or practical solution (T. Anderson & Shattuck, 2012; S. Barab & Squire, 2004; diSessa & Cobb, 2004; Edelson, 2002).

DBR researchers accomplish this by working to shape a local solution that is theoretically oriented. This is done during the process of development by collecting data that informs design of the local solution but also support claims about learning that generate or deepen theoretical knowledge (Barab & Squire, 2004). Barab and Squire cite anthropologist Clifford Geertz (1976, 1983), stating that research findings in DBR should represent both "experience-near significance and experience-distant relevance" (p. 5). Indeed, it is this dual purpose that sets it apart from other methodologies. This dual purpose creates an opportunity for robust and relevant theories and practical interventions. The dual purpose of DBR is represented in this work; indeed, the study has resulted in instructional resources and some preliminary generalizations about digital literacy instruction in similar contexts, with the understanding that this is DBR work in its early stages and through more iterative study more robust theory can develop.

Main Philosophical Underpinnings of DBR

Bell (2004) and diSessa and Cobb (2004) describe the difficulty in defining theoretical underpinnings of DBR, each suggesting it is difficult to do so because of the messiness of research in education requiring a range of scholarly perspectives to address issues. Indeed, DBR literature represents references to a broad range of theoretical underpinnings.

Dewey's Pragmatism

Though DBR's theoretical underpinnings are interdisciplinary, its approach to theory construction through the process of creating design-based solution to a local problem is incredibly pragmatic, and this is why I am drawn to its use in the context of community-technology lab based computer skills classes, which have not been much studied and where there is great need for useful instructional resources. The philosophical work of American pragmatists, especially Dewey, has been frequently referenced in DBR literature. Perhaps the first significant work, Brown's (1992) article both describing and defending DBR, cited heavily from Dewey. Much of her article presents an argument differentiating her work from Dewey's, in response to critics who had suggested her work was a recapitulation of Dewey's ideas of readiness to learn, discovery learning, and the curriculum and society.

Barab and Squire (2004) in their article situating DBR as a useful tool for learning scientists, aptly characterize it as pragmatic enterprise with respect to theory development.

> Design-based research that advances theory but does not demonstrate the value of the design in creating an impact on learning in the local context of study has not adequately justified the value of the theory. (p. 6)

They point to this requirement as "a pragmatic philosophical underpinning, one in which the value of a theory lies in its ability to produce changes in the world" and draws from "pragmatic lines of inquiry where theories are judged not by their claims to truth, but by their ability to do work in the world (Dewey, 1938)" (p. 6).

Anderson and Shattuck (2012) in their literature review of popular DBR research of the 2000's align DBR with pragmatism by pointing out how the studies illustrate DBR's methodological and epistemological flexibility, which allows researchers to employ theoretical frameworks and methods as called for in their inquiry. Dewey's pragmatism is evident in DBR, they add, in its commitment to lasting change in schools.

> Dewey realized that new meanings, values, and attitudes become encultured in schools only when they have become embodied and are sustained within real-life contexts. This requirement to develop practical design principles is a key strength of DBR, and it disadvantages those types of research that unilaterally descend for testing in a classroom and

then disappear with the researcher once the experiment has been concluded. (p. 17)

This pragmatic approach to understanding education, one that is motivated to create sustainable change is well-suited to structure inquiry on how instruction and educational environment mediate learning. Acknowledging that the goal of DBR is to build an instructional intervention to solve a very real problem, then a lens requiring focus on how elements in an educational context impact teaching and learning is needed. For this reason, I think that sociocultural theory (SCT) and DBR pair nicely as the theoretical framework and the methodology for this study.

SCT as an Orienting Theoretical Framework

Explicit and thoughtful consideration of a theoretical lens is critical in DBR because it is an approach to educational research that is both grounded in theory and seeks to drive development of new theories (Wang & Hannafin, 2005). diSessa and Cobb (2004) suggest different roles for theory in DBR research. In my work, SCT serves as what they might label an 'orienting framework', defined by diSessa and Cobb as theory that informs instructional design and useful because it provides shared vocabulary and background knowledge for researchers. As an orientating framework; however, it is limited in utility because much of what goes into design research is beyond the explanatory power of any one framework. Rather than providing constraints or prescriptions for action or design, orienting frameworks inform general parameters influencing how to think about "learning, teaching, and instructional design" and can be embraced as "meta-theories" (diSessa & Cobb, 2004, p. 81). SCT works as an orienting framework for my study because the dissertation as a whole explores instructional practices from the teacher perspective and accounting for how instruction mediates learning. This is a sociocultural view, where learning is mediated by environment, resources and the interactions therein (Engestrom, 1999; Lave & Wenger, 1991; Vygotsky, 1978).

Sociocultural Theory

Vygotsky called this theoretical lens ‘cultural historical’, acknowledging both human development over time and cultural influences that shape that development. The theory represents a dialectic view of psychological theory, where the organic (the brain) and the cultural both impact the mind (Lantolf & Poehner, 2008). This is depicted in a triangular model drawn by Vygotsky in the 1930’s, which shows that a connection between a stimulus (S) and a behavioral response (R) is not linear or uninterrupted; rather, it is mediated or influenced by an “auxiliary stimulus”, as shown as “X” in Figure 1 below. Vygotsky wrote that the model represented a simplified representation of the means by which “higher psychological processes” occur.

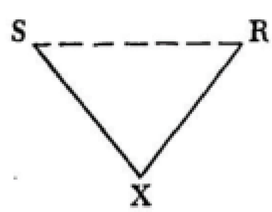

Figure 1

Figure 2.1 Vygotsky’s stimulus response model (Figure 1 from Vygotsky, 1978, p. 40)

This model is useful for characterizing what happens in educational contexts. In Vygotsky's sociocultural theory, the stimulus "X" is any tool or cultural sign (language, interaction, artifact) by which one attains higher psychological functioning. Vygotsky viewed "signs" as a tool or instrument of psychological activity. In schooling, this is anything that supports, inhibits, or otherwise shapes learning. By incremental development, a child (in Vygotsky's writing, in my case an adult learner), internalizes, makes use of, or draws upon (use as stimulus "X" as in figure 2.1) increasingly more complex cultural signs. This observation was based on child development research and Vygotsky's view that learning and development do not occur simultaneously; rather, learning pulls one into new developmental stages that serve as springboards to subsequent learning. This is the well-known concept the Zone of Proximal Development.

> The zone of proximal development defines those functions that have not yet matured but are in the process of maturation, functions that will mature tomorrow but are currently in an embryonic state. These functions could be termed the buds or flowers of development rather than the "fruits" of development. (1978, p. 86)

Building on this, Engeström's Activity Theory is useful for further understanding a range of factors that mediate learning in an environment (Lantolf, 2000). Activity theory suggests that learning occurs through action or activity in a given context and that this activity itself is shaped by a range of factors (Engeström, 1999). Remember that in Vygotsky's theory of development, a person internalizes signs, masters them and integrates them sufficiently to draw upon them in higher order thinking (current or future learning). The signs or tools that are presented to learners are context dependent; Activity Theory is a framework for characterizing those cultural and situational influences in a given activity system. According to Engeström (1999), the activity system is comprised primarily of:

Subject – the one engaged in an activity,

Object – the intention of the activity or the goal,

Tools and signs – anything used to complete the activity (computer, language, curriculum).

Additionally, several components impact the way that subjects use tools or signs to affect the object:

Community – the collective; others in the activity system that contribute to meaning making,

Rules – conventions or expectations defined by the community

Division of labor – assignment of activities to different members of the community in an activity system.

This interconnected system is best represented visually in Figure 2.2.

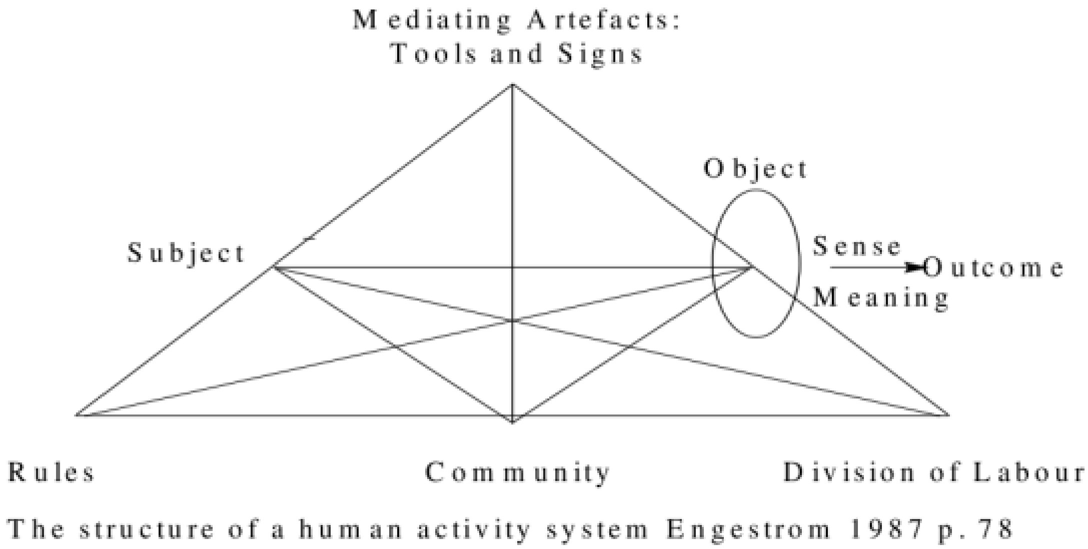

Figure 2.2 Engeström's Activity System model

Together, each part of the activity system contributes to shaping how the activity of the subject results in an eventual outcome (Engeström, 1999). All components are at play in determining the shape of that outcome. The activity system in my research is each of the participant site classrooms, where the 'subject' is the TAC member, the 'object' is learners, the 'mediating artifacts' include instructional strategies and resources, and the 'outcome' is computer skill development. This model and its utility as an orienting framework for my study will be more completely described in Chapter 4.

Required Elements Triad: Frameworks for Action

The orienting frameworks come together in what diSessa and Cobb (2004) describe as a framework for action. Such a framework is a pedagogical strategy that provides a focus that helps shape design and serves as a heuristic for determining its impact. A framework for action is significant because it helps us manage the gap between theory and design. The framework for action should align with the focus of the inquiry or present direction for solving the local problem. The framework for action in this study is drawn from Silver-Pacuilla and Reder's (2008) literature review conducted to explore prior research in order to characterize the skills threshold required for successful learning through online technologies. They investigated three sources of information: large-scale surveys, research literature on adult literacy and learning online, and observations made by experts in the field, triangulating the information gleaned from these sources.

This research suggested that anyone could learn using online technologies given an equitable balance amongst three variables: "interaction among the learners' skills, the opportunities they encounter, and the supports available" (p. 4). Silver-Pacuilla and Reder (2008) wrote that achieving the required balance amongst these elements in "instruction, program planning, and content development" (p. 1) is critical for expanding the audience of learners who can benefit from online learning opportunities. Figure 2.3 illustrates this relationship.

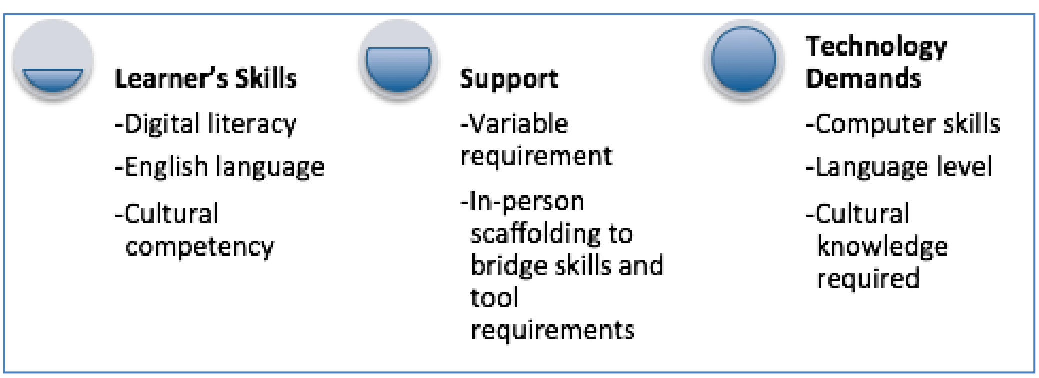

Figure 2.3 Rendering of Silver-Pacuilla and Reder's (2008) Required Elements Triad

I view this framework for action as providing focus on aspects of the Engeström's Activity System model, where the components' 'support' and 'technology demands' figure into what defines the mediating categories that lie between 'subject' and 'object'. I suggest that that it is the teachers' instruction, the materials, the site (i.e., the rules and nature of the community), and the roles therein (e.g., teachers acting as facilitators or taking a more controlling positionality) that mediate learning. Silver-Pacuilla and Reder (2008) suggest that if characterized by appropriate quality and level of support, mediation can make it possible for anyone to make use of online learning opportunities.

Understanding the factors at play in mediating learning is particularly important in this context because, as past research has shown, most instruction of digital literacy occurs using computers and the internet (Eubanks, 2011; Jacobson, 2012); that is, digital technologies are both the content of instruction and environment in which it is taught. Teachers in this activity system, therefore, have the added burden of not only providing support to meet the demands of learning content but also of needing to rely on that very content for instruction. Recognizing and then leveraging the power of all mediating factors of an activity system support instruction.

DBR in Relevant Second Language Education Literature

A review of literature using search terms intended elicit articles and books reporting on DBR studies in second language and, specifically those that include English language (EL) learning and/or learning technologies yielded only a handful of articles.

Most of them reported on using DBR in development of learning technologies for language study. Several addressed uses of DBR in development of professional development for language teachers.

Learning Technologies for Language Study. A notable example of research integrating language and technology in DBR studies is provided by Hung (2011), who wrote about using DBR to design reflective tasks done in multimedia environments (mostly digital video) in support of English language learning in a Taiwanese university. The focus was a study of design iterations of a reflective task developed over the course of two years. The strength of this article is the connections it makes to learning and media design theories. A second notable strength is the focus on the actual design in the inquiry. Indeed, the second research question reads, “How do different designs of reflective tasks affect the nature of the students’ video-enhanced reflections?” (p. 165). The impact of these two strengths is that future researchers will see the relevance of the work for their own contexts.

Another useful example is the Liu, Liu, and Hwang (2011) study of DBR work done to create evaluation criteria for English learning websites. The primary strength of the article is a detailed description of the process or steps used to conduct the research, drawn from Collins et al. (2004). They provided a detailed description of how their data collection and analysis followed the steps. Their research consisted of a layered approach to the development of criteria, done through a structured process of gathering input on evaluation criteria from literature, experts, and student survey. After each round of information was gathering their lists of criteria was refined, resulting in lists of criteria regarding web usability, learning materials, functionality of assisting language learning, learner preferences, and technology integration. The significance of the study is limited because of lack of testing with actual teachers, underdeveloped references to the theory on which the design was grounded, and lack of description about theoretical contributions to either the field of language learning or materials evaluation.

Pardo-Ballester and Rodríguez (2009) used DBR to support the development of language learning materials based on multiple theories of second language acquisition (SLA) and computer assisted language learning. The context of the study was a hybrid (online and in-person) university Spanish course, which they suggested was the first study to apply DBR to language learning. The paper is unique in that it specifies the utility of DBR in SLA research. The authors state that the iterative and collaborative aspects of DBR make it ideal for developing high quality language learning materials that are relevant for "the mode, context, and content of language instruction" (p. 98), appropriate for diverse populations of learners; make differentiation according to learners' interests possible, and result in online environments well suited to support language learning.

Teacher education literature. Additionally, there are a few articles connecting the themes of language teaching, teacher education, and use of technology in instruction. Egbert, Herman, and Lee's (2015) study used DBR to explore a flipped ESL teacher education course for mainstream teachers. The paper stated that it had hoped to focus on providing design specifics and principles for design as it explored the impact of flipped instruction in teacher education. Their iterative process produced a flipped PD experience that included fieldwork, video, and structured online learning. The article clearly described how changes were made between two iterations of the intervention to address issues revealed through use.

An incredibly useful body of work is a dissertation study and two related published articles that explored teacher education designed to help teachers integrate ideas from Systemic Functional Linguistics[4] to better support ELLs in English Language Arts (ELA) programs in early elementary schools in the US (Moore, 2014; Moore & Schleppegrell, 2014; O'Hallaron, Palincsar, & Schleppegrell, 2015). Moore's (2014) dissertation comprehensively examined strategies for supporting ELLs in ELA classes and the impact of professional development materials and design on that instruction. The dissertation included three separate but aligned studies exploring a.) students' classroom conversations about literature and the academic language that constituted those

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[4] SFL is an approach to understanding language that considers it to be a social semiotic system. It was developed by linguistic by Michael Halliday in reaction to overly cognitive and structural accounts of language development. Academic Language is a pedagogical approach and view of language that employs SFL to support making explicit connections between linguistic structures and meaning in order to support learning of academic subjects.

conversations, b.) the impact of writing instruction based on sociolinguistic genre theory and students' use of academic language in conversations about their writing, and c.) the iterative research and design process that resulted in both professional development materials and learning activities intended to support the development of instructional approaches employing academic language to support ELLs in ELA classes.

Moore wrote that the DBR process elucidated useful practices for employing academic language to support development of skills required to succeed in ELA classes. The dissertation very clearly defined DBR and showed how a DBR process, carried out with narrative inquiry, improved application of SFL principles in literacy instruction in lower elementary ELL classrooms. It referred to McKenney and Reeves (2012) for research process and Cobb et al. (2003) and Confrey (2006) for justification of how it was both grounded in and extended SFL theory. It is a very strong representation of the iterative process of development of the PD sequence.

DBR in this Study

The structure of this DBR study is best represented in terms of the cycles of Educational Design Research (EDR) presented by McKinney and Reeves (2012). Together my studies make up the first meso-cycle, as shown in figure 2.4 below.

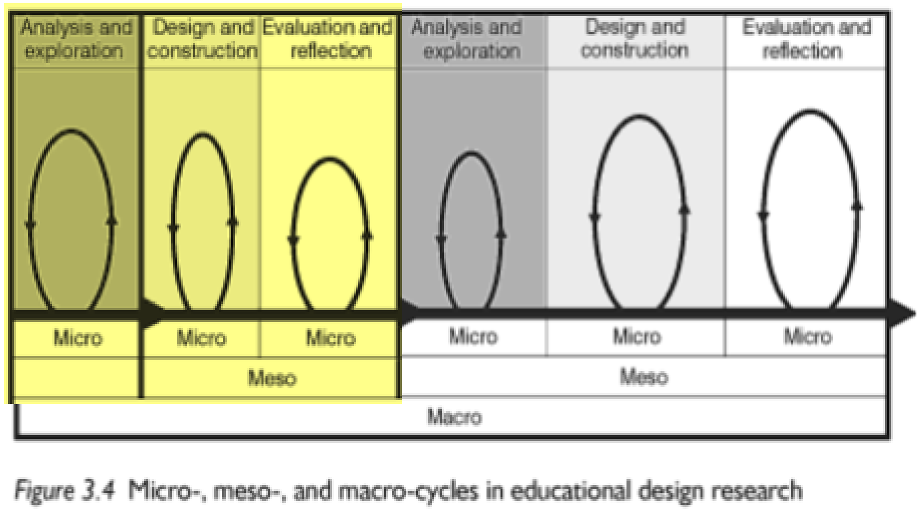

Figure 2.4 EDR Research Cycles (Figure 3.4 in McKinney & Reeves, 2012, p. 78)

The authors created this model to depict subcomponents of the phases required for completion of both design research and resource development. A macro-cycle reflects the overall process for an EDR study. The meso-cycles that constitute each macro-cycle represent what the authors refer to as a regulative cycle. Drawing on van Strein (1975, 1997) they defined this as the process for or phases of applied research: “problem; identification; diagnosis; planning; action; and evaluation” (p. 8). A meso-cycle might define the scope of developing a prototype of an instructional resource, which is then tested in another environment (requiring depiction in a second meso-cycle). There is no fixed number of meso-cycles required for a macrocycle; rather, it depends on the scope of the research.

Next, they divided each meso-cycle into micro-cycles, which embody what the authors call “logical chain of reasoning” (p. 78). Each micro-cycle allows for its own cycle of flexible and iterative exploration of ideas. This is illustrated by the circular arrow within each rectangle. Though they did not articulate why the circles vary in size, I understand it to reflect variation in scope of work that results from unpredictability inherent in design projects. No model can aptly reflect the reality of all EDR. For example, in the prototype example I shared above, the circle representing the ‘analysis and exploration’ micro-cycle of the second meso-cycle is smaller than its corresponding micro-cycle at the beginning of the study. One might imaging that the analysis and exploration phase at the initiation of EDR would be more robust that is required after the issue is more deeply understood at the beginning of the second meso-cycle.

McKenney and Reeves suggest that ‘analysis and exploration’ and ‘evaluation and reflection’, the first and third phases, are empirical cycles because they require data collection and analysis. The ‘design and construction’ phase is informed by the empirical study that preceded it but does not “by itself” constitute an empirical process, rather it will “follow a sound, coherent process to produce an intervention in draft, partial, or final form” (p. 78). Note that this varies from the way design proceeds in the DBR described by Cobb et al. (2003), which suggest a more rigidly defined process for design and testing, perhaps one that adds an empirical approach to this phase. I attempt to lay a more empirical layer on the design and construction phase by drawing on Sandoval’s conjecture mapping approach to DBR, described in Chapter 4 (see Sandoval, 2004; 2014).

The micro-stages of the meso-cycle represented in my studies are presented in Table 2.1.

Table 2.1

Stages of the study

Micro-cycle Name	Pilot	Study 1	Study 2	Study 3
Focus	Learner experience	Defining challenges	Building resources	Exploring language
Analysis and exploration	X	X		
Design and construction			X	X
Evaluation and reflection			x – initiated	x - initiated

The Pilot Study and Study 1 make up the analysis and exploration phase of the first meso-cycle of my work. These two studies build on each other. Findings in the Pilot Study included observations about the impact of instructional strategies and resources on learning, and suggested that untrained volunteers and teachers experience challenges in the classroom that can be mitigated by instructional support resources. This implication from the pilot needed to be confirmed or contested by exploring the issue from the perspective of the minimally trained and novice teachers, hence Study 1.

Studies 2 and 3, representing the ‘design and construction’ phase, unfolded in tandem as we designed and then built the instructional resources. Study 2 focuses development of the resources. Of note is that it is difficult to put a boundary on the end of this study. As you will read below, the addition of a new focal participant toward the end, contributed positively to the development of the tool, and these shifts contributed to the knowledge developed, so I include it in the study. Study 3 focuses explicitly on the role of English language and literacy in the development of these resources and in the instructional choices of the teachers.

The ‘evaluation and reflection’ phase is not a study, per se, in this work; rather it is represented in the final Chapter of the dissertation, which presents implications of the studies as a whole and summarizes what has been learned so far about teaching and learning in my focused context.

Research Questions

Within this structure and motivated by the frameworks previously described, this dissertation address the following defining questions, explored in the three complimentary studies.

1) What challenges are evident in the instruction provided by and articulated in the observations of untrained teachers when working with adult ELLs in digital literacy classes. What resources do they identify as helpful in mitigating these instructional challenges?
2) What prioritized characteristics of an online instructional environment emerge during the design process of an online instructional resource for teaching digital literacy skills? What does the process of creating the resource for diverse

student audiences reveal about which learner needs are most salient to novice teachers?

3) What are the particular linguistic structures evident in observed classroom discourse and participant descriptions of teaching digital literacy? What instructional strategies employed by service corps members promote opportunities for learning this academic language in support of digital literacy development?

In this alternative dissertation, findings from each stage inform the next. By this means, the DBR methodology propels the work to practical and theoretical results by responding to unexpected turns revealed in process. The research adds to current knowledge about construction and use of web-based materials supporting digital literacy instruction, particularly that provided in a second language, by elucidating critical guidance required to support lab facilitators and teachers not formally trained as materials developers but who are nonetheless required to provide access to online learning resources as part of their instruction. These studies fill a significant gap in current research regarding how to shape the support side of the previously mentioned required elements triad for adult ELLs in digital literacy classes (i.e., Silver-Pacuilla and Reder, 2008). It articulates strategies and builds knowledge about how components of an activity system (in this case well-constructed learning environments, appropriate materials and resources, technology tools, and pedagogy designed to support academic language proficiency) work together to mitigate the lack of formal training and prior experience of the teachers.

Setting

The participating agency, called the Technology Access Collaborative (TAC) in this study, has been working for over a decade to mitigate the “digital divide” in an upper Midwestern metropolitan area. TAC is an AmeriCorps program and is, hence, funded by Congress through the Corporation for National and Community Service (CNCS). AmeriCorps members are provided living allowances for 12 months, and receive an educational stipend following successful completion of their year of service. TAC places AmeriCorps members in partnering community-based organizations to help community members learn to use computers and the Internet. Program participants served in the partnering organizations include youth and adult migrants, low-income residents, and persons with disabilities. The program also seeks to help the staff and volunteers at the CBOs utilize new technologies to better support their service participants, connect with existing civic, social service and community resources.

In 2015-2016 fiscal year, 35 TAC members were placed at 22 organizations. This study is based on the work in five partnering CBOs, and one site that supported a TAC member the previous year (the pilot study). Each site, anonymized with a pseudonym, hosted a TAC member to provide digital literacy programming in community-based technology labs frequented by migrant adult learners. The programs are all different, representing the breadth of organizations who are part of the TAC collaborative.

Project Integrate. The CBO's mission is to provide multiple and integrated services to help low-income people become self-reliant. The services, which include housing, employment training, and provision of support services, reach approximately 14,000 low-income people each year. As part of its employment training, it provides access to computers and digital literacy instruction coordinated by two AmeriCorps program members, working in a community technology lab.

Ascend. The nonprofit provides support to a diverse community of clients struggling to overcome challenges posed by economic stability. Services include assistance finding jobs and housing, and educational opportunities. Ascend offers classes to adolescents and adults supporting workforce training and computer skills with the goal of helping community members achieve economic and social stability.

Newcomer House. Newcomer House is a multiservice community organization founded over 100 years ago. The organization serves more than 11,000 primarily low income families, refugees and immigrants each year. Nearly all program participants live at or below the poverty line, are persons of color, and speak a home language other than English. The program mission includes helping community members develop digital literacy to support full economic and civic participation.

Global Institute. Global Institute serves newcomers: refugees, asylees, and immigrants. All students are low-income and over 70% are unemployed. It provides a broad range of services, housing, job placement, and support for achieving higher education. GI provides computer classes to students with some English language proficiency to help them develop the technology skills needed for employment or further education.

Library Lab. The Library serves a diverse population of city residents in classes focused to support job seekers and other learners wishing to build digital literacy skills. Outreach is often directed to reach to under-served groups, including a number of learners who are homeless.

Digital Youth. Digital Youth is a community education program of a Suburban public access community television organization. Through multiple programs, Digital Youth supports a diverse group of students as they work collaboratively, learning basic technology skills and creating quality culturally-relevant media.

Because the mission and the community setting of the sites vary, the learners served in computer classes also varies. Table 2.2 shows basic information about the students, contributed by the CBOs or TAC members, who attended the computer classes and in which study each site participated.

Table 2.2

Technology Access Collaborative (TAC) sites' students

Site	**Students' home language(s)**	**Education/English level**	**Study Number: Program Year(s)**
Project Integrate	Somali & other African, Spanish, English	Adult learners. Mixed level; early	Pilot: 2013-14

		literacy to college transitions	
Ascend	Mixed Horn of Africa languages	Adult learners. Mostly very low literacy; some GED prep level	1, 2, 3: 2015-2016 2016-2017
Newcomer House	Spanish; Some diverse African and Southeast Asian languages	Adult learners. Mixed level; early literacy to transitions	1, 2, 3 2015-2016 2016-2017
Global Institute*	Diversely international context	Adult learners. Mixed level, but both levels of previous education and English language higher than in other sites. Several students from professional class in home country	1, 2, 3 2015-2016 2016-2017

Library Lab*	Mostly English; periodically Spanish, Somali or Vietnamese	Adult learners. Very mixed; mostly low-educated; little to no prior computer experience	1, 2, 3 2015-2016 2016-2017
Digital Youth*	Mostly English	Middle to high-school aged; high literacy	2 2016-17

* Focus group data from TAC members from these sites was integrated into analysis, but classroom observation data was not because these sites did not have serve low-level ELLs.

The primary study sites, Ascend and Newcomer House, along with Global Institute and Library Lab all participated in Study 1, Study 2, and Study 3, the studies which informed the 'analysis and exploration' and 'design and construction' phases described above. Project Integrate participated in an earlier study, which served as a pilot and contributed findings that motived the primary studies. Finally, Digital Youth, participated in Study 2, at the end of 'design and construction' phase. Each organization had one TAC member offering computer classes or training in some form. The TAC members, the focal participants of the study are introduced in Table 2.3

Table 2.3

Focal participants

Site Pseudonym	TAC member	Prior education	First language	Languages shared with students
Project Integrate	Leanne	Bachelor of Arts	English	
Ascend	Erik	Bachelor of Arts	English	
Newcomer House	Marty	Bachelor of Arts	English	Spanish
Global Institute	Donna	Bachelor of Arts	English	Spanish
Library Lab	John	Prior education and career in Computer Science field	English	
Digital Youth	Samantha	Bachelor of Arts	English	

These six AmeriCorps participants represent a convenience sample, who in fact, self-selected as participants in the study. This means by which to recruit participants was advantageous for this study because of the goal of collaborative development of an instructional resource. Without motivated participants, there would not have been a process of development to study.

The primary sites' TAC members were part of a small team that came together to complete a civic-engagement project in program year 2015 - 2016, a required activity in the AmeriCorps program. Each year members of the entire TAC body form together into small teams to complete a project that contributes positively to supporting digital inclusion in their community. Through my work with the AmeriCorps program, I had led a workshop on the role of digital literacy in mitigating digital exclusion, suggesting that explicit research on how to best support adult ELLs was needed. These members responded to my invitation to work together to explore the issue. The TAC member from the pilot study, program year 2013- 2014 had agreed to participate the previous year in response to a similar invitation. The TAC member who joined in program year 2016-2017, during the 'design and construction' phase had heard about the work in the previous program year and wanted to take part, in a second community engagement project intended to support dissemination of the resources created by the primary site participants.

Collaboration with TAC members working to support ELLs with digital literacy skill development fulfills a DBR requirement of research grounded in local educational challenges and supports creation of a tool that can be useful to other untrained teachers impacted by the problem (Anderson & Shattuck, 2012; McKenney & Reeves, 2012).

Data Collection Methods

Though a more detailed description of the data collection processes is included for each of the three studies in this dissertation, it is useful to share an overview showing how each study informs the DBR methodology employed as a unifying approach to the work as a whole. Table 2.4 presents such an overview.

Table 2.4

Data collection methods

Site	Study	Data Collection Methods Employed
Project Integrate	Pilot	Observational Data: audio data, transcripts, field notes Instructional materials Interviews: transcripts and memos
Ascend	1, 2, 3	Observational Data: audio data, transcripts, and field notes Instructional materials Focus groups: transcripts and memos
Newcomer House	1, 2, 3	Observational Data: audio data, transcripts, field notes Instructional materials Focus groups: transcripts and memos
Global Institute	1, 2, 3	Observational Data: audio data, transcripts, field notes Instructional materials Focus groups: transcripts and memos
Library Lab	1, 2, 3	Focus groups: transcripts and memos Instructional materials
Digital Youth	2	Focus groups: transcripts and memos

Note that Study 2 extended across the TAC member service year, so Samantha from Digital Youth joined the team to assist in completion of the web-based resource.

Focus group discussions with the TAC members provided first-hand information about their experiences as education practitioners. Focus groups are an effective tool for qualitative research. Krueger and Casey (2015) suggest they are better than individual interviews when you want ideas representing an entire group to emerge. The efficacy of focus groups was first observed during research on military morale during WWII, where group discussion was found to comfort those in conversation. The group setting helped participants feel more comfortable and more open to providing rich responses to questions. Indeed, in a group discussion, ideas emerge from the dynamics of the members of the group – creating a synergy amongst the members (Kruger & Casey, 2015).

Observational data, artifacts gathered at the time of each observation, and the TAC members' own field notes served as an additional data point to support the claims made by TAC members in the focus groups and in informal conversation. These data, along with my field notes and analytic memos, serve as a critical source of data for the triangulation required for validity qualitative research (Anfara, Brown, & Mangione, 2002; Mathison, 1988).

There are a few points in the table above that require further development. First, the role of the pilot site was to better understand the ELL experience in community-technology labs; it relied on a range of qualitative research methods including classroom observation and interviews with learners and the TAC member. The findings generated from this data framed the subsequent study. Data critical for development of the intervention resources was gathered at the primary sites, Ascend, Newcomer House, Global Institute, and Library Lab. The Library Lab site did not have English language learners present for observation, or with much frequency at all over the program year. Though the TAC from Library Lab participated in the focus group discussion, data contributed was less generative because there were no ELLs in his classes and his job changed during the course of the study.

At the three primary sites that largely served ELLs, Ascend, Newcomer House, and Global Institute, observational data, focus groups, and participant interviews provided information to guide the design of the resulting intervention resources. Data gathered provides information about current beliefs and practices about digital literacy instruction, including: the topics currently covered in a digital literacy program, preferred materials and pedagogy, context-specific limitations, and self-perceptions of instructional skill. Further, classroom observation data and responses to focus group questions about their experience as instructors provide information about the role of English language in digital literacy instruction. Information gleaned through this work informed the intervention and provided the means to develop theory about how to provide support for untrained instructors teaching ELLs in digital literacy labs.

Positionality and Ethics

This dissertation is the culmination of two decades of practitioner work and several years working as a developer of online content and professional development facilitation for teachers of adult ELLs. A priority of my practitioner work has been to empower teachers to think critically about technology integration in instruction and to build their own digital literacy skills. For these studies, I was situated as a participant observer and researcher known by the participants to be seeking knowledge about how to best support ELLs in digital literacy classes. The Corps members viewed me as an expert on the topic and as a co-author of the assessment tool their program used as an outcome measure. When needed, I helped both the participant AmeriCorps members and their students. This was an ethical choice stemming from my opinion that persons with expertise should contribute when put in a position to do so. I have been working in the field of adult ELL instruction for nearly twenty years, most recently as a designer of curriculum and online materials for instruction and assessment of digital literacy skills (indeed, I was known to the participants as an educational consultant supporting the development of the digital literacy assessment used in the CBOs).

The TAC members who staff the computer lab who, though they have been successful students, have little formal training in teaching and are often unaware of the issues that serve as barriers for the ELLs in their workshops and labs. Therefore, I have been actively engaged in supporting both the learners and the service corps members during my time at the CBOs and my observational notes include documentation of suggestions about how to improve the programming therein.

CHAPTER 3: ANALYSIS AND EXPLORATION (PILOT STUDY AND STUDY ONE)

The first stage of this DBR is composed of two qualitative case studies designed to elucidate the instructional challenges of basic computer classes held in community-technology labs: a pilot study where the issue of learners not receiving adequate support for learning first took shape, followed by a collaborative study to better understand the instructional challenges from the perspective of the Technology Access Collaborative (TAC) AmeriCorps members who teach them. Together the two studies form the analysis and exploration phase of Educational Design Research (EDR) recommended by McKinney and Reeves (2012) "to shape a better understanding of the problem to be addressed" (p. 85).

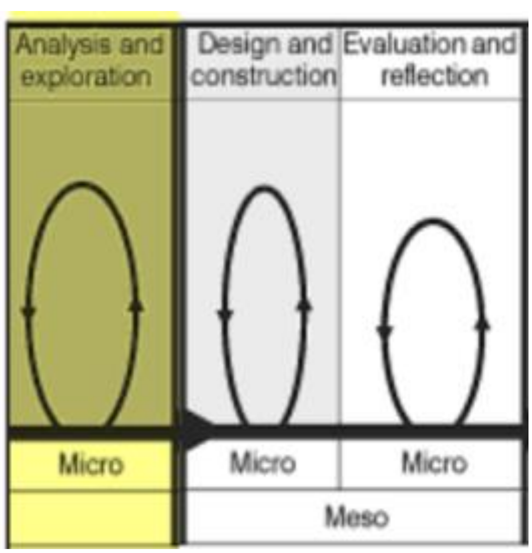

Figure 3.1 EDR Research Cycles *(Figure 3.4 in McKinney & Reeves, 2012, p. 78)*

In this phase of EDR, indicated in Figure 3.1, collaborating participants focus on investigating an instructional challenge and begin to form ideas about ways to mitigate it, drawing on their practitioner experience and research-informed input (and even literature) shared by the researcher. The analysis and exploration phase concludes with an agreed upon approach or possible solution that is designed and constructed in the micro-cycle that follows.

Pilot Study: Exploration by Focusing on Learner Experience

The first study of the EDR analysis and exploration micro-cycle is where the issues of migrant adults struggling in computer classes was first made evident. The study was conducted to better understand the learning ecology and possible impact on adult English language learners (ELLs) participating in digital literacy instruction in basic computer skills workshops held in a community-technology lab. The research explored learner viewpoints and experiences to uncover learner priorities and attendant investments of time and commitment to instruction and how these investments may be motivated by the world around them, their social interactions, and their aspirations for their future participation in society. The theoretical perspective informing the inquiry was that learners' contexts of interaction mediate language and other learning and that learner identity and language learning, rather than being informed solely by cognitive and sociocultural constructs, are shaped through interactions and power relationships represented in the larger social world (Norton-Peirce, 1995).

A Poststructural Lens for Exploring Learner Identity and Investments

Pavelenko and Blackledge (2004) argued in their book on multilingualism and identity that using a poststructuralist lens to consider language use, identity, and learning provides a means to explain how identities are crafted in different contexts. Toohey (2000), in her book on identity and elementary school English language learners, observed that identity is not a fixed construct and how one is positioned or positions oneself in society impacts perspectives about identity and what and how a person communicates. This social positioning happens in schooling because skills privileged in an educational setting determine what gets taught. Because learning opportunities are socially constructed, learner identity is shaped by schooling. In the case of the second language English learners in her study, this meant that learners took on the language in specific contexts and used it to engage in required activities with in that context. Learning and speaking English became (or had to become) an important aspect of their identities.

Key to this perspective is the poststructuralist view that learner identity is multiple, varies across time and space, and is dependent on the context and interlocutor and the power or perceived power relationship between learner and interlocutor. Norton writes that identities are shaped through interaction and with our relationship within a larger social world as mediated through institutions (Norton-Peirce, 1995). In a classroom context interactions shape identity of ELLs with respect to their ability participate and learn.

Investment in learning. Darvin & Norton (2015) built on this work by highlighting ideology and its role in determining learner agency in a given context. They described a complex relationship between learner identity and the commitment to learn or use language, which is mediated by dominant ideologies and learner’s cultural and social capital. They drew on Bourdieu (1986) when defining both terms (e.g., social capital as connections as networks of power, and cultural capital as "knowledge, educational credentials, and appreciation of specific cultural forms" [Darvin & Norton, 2015, p. 44])

Where motivation theories of SLA fail to account for all competing priorities and barriers in a learner's life, Norton and Darvin's model of investment can. A learner may be motivated but context, interlocutors, prevailing ideologies, and learner perceptions about his or her position in the larger target language community all shape investments in learning and interaction. The alignment of a learner's estimation of his or her social capital and the social capital they wish to attain is measured against the value placed on that current capital and affordances by mediating ideologies; this is what shapes success or spurs investment.

Norton (2013) demonstrates that perceived alienation from target community decreases investment and negatively impacts language learning. Norton draws on the concept of possible selves, which is defined as one's self-concept projected into the future yet shapes current behavior (Markus & Nurius, 1986). Choices about investment are often made based on a learner's projection of their possible selves and give us a glimpse of those communities, in the future, to which learners expect to belong because of their investments.

My research represents an extension of the literature addressing the role of identity and investment in learning to include learning in the context of digital literacy instruction. Understanding that digital technology has extended the venues of language use and participation in society, it stretches these theoretical frameworks to explore identity and investment of adult migrants working to develop basic computer skills. I aim to show a connection between the instruction provided by the TAC members, untrained teachers, and its potential limiting impact on learner identity and investment in a community technology lab basic computer class.

Research questions. It is generally understood that digital literacy skills are essential for full participation in modern US society but little published research on the impact of the most widely available programs (like the one studied here) or how learners themselves see digital literacy as a priority. To fill the gap in the literature, I explored these issues through research organized by the following research questions.

1. How do adult English language learners' observations about schooling, literacy, and technology use reveal their perceptions of their place in our technological society?
2. How do adults construct or co-construction their identity through digital literacy learning opportunities and use of computers?

Because so many adult learners require the use of these CBOs for digital literacy instruction it is important to understand how they fare within the program studied here, especially with respect to the impact of the program on their identity and learning.

Methodology

The methodology of case study was ideal for this research because, as Merriam (1998) writes, case study is used to describe a process for doing research that "uncovers

[the] interaction of factors characteristic of a phenomenon" and to arrive at a "holistic description and explanation" (p. 29). Merriam described case studies in education as a heuristic, illuminating a reader's understanding of a phenomenon, and thickly descriptive. The bounded case in this study was Project Ignite, the CBO where the digital literacy-training program was based. The CBO is representative of many organizations of its size and type, providing computer classes to clients who make use of multiple services on site.

Data sources. This research study included the following data sources:

1. Observational notes from 21 hours of lab workshop and meeting time between November 2013 and March 2014
2. Reported conversation with the TAC member and administrators at the site
3. Demographic data of focal participants and anonymized, aggregate data of all participants
4. Activity and results recorded in online learning sites
5. Interview transcripts
6. Transcripts of recorded instructional interactions

Each of these data sources played an important role in the investigation. Because I drew on a range of rich data sources, I was able to check my own observations against records of what occurred in the classroom or the interviews. Such triangulation among multiple data sources supports validity of findings and provides the means for more richly illustrating or describing social phenomena (Anfara et al. 2002; Campbell & Hall, 1988).

The learner interviews were done to explore learner investment in education and how technology training intersected with learner identity with respect to the learners' agency with technology. I chose to interview learners who had I helped when I audio-recorded my participant observer activities in the lab. My interviews were semi-structured, set up to ensure adequate planning for covering the same topics with each interviewee, but allow for flexibility and a conversational approach that encouraged relevant information and topics to emerge (Cohen, 2006). Additionally they can be characterized as responsive, consisting of main questions supported by follow-up questions and probes planned but utilized as required during each conversation (Rubin & Rubin, 2012). I conducted my interviews in English and used the same basic interview protocol with each participant, simplifying the language of the questions as required, but not so much as to elicit different information (See Appendix A for the interview protocol). Rubin and Rubin (2012) present this as an alternative to using an interpreter, which they suggest complicates interviewing due to issues with interpreter comprehension of the nuances of the question and these nuances being lost in translation of both questions and responses.

Site and participants. The site for this study, Project Integrate, has a mission that includes providing multiple and integrated services to help low-income people become self-reliant. The computer classes observed were part of employment training at the community based organization (CBO) and were led by Leanne, a TAC member with no previous experience or training as an instructor and in her first year of teaching.

I visited the site periodically for over four months in 2013 and 2014 for a total of twenty-one hours, during which time the CBO served 198 people through computer the computer skills workshops. The instruction happened in cohort-managed learning of up to twenty participants, who were encouraged to attend four days of the two-hour facilitator-led computer skills workshops on topics aligned with the Northstar Digital Literacy Assessment: Computer Basics, Internet, Email, and Microsoft Word. After the workshops, the participants had the opportunity to take the Northstar Digital Literacy Assessment, an online interactive tool designed to help learners and education program staff identify learning needs (Vanek, 2013). On average, participants attended 3.72 workshops during the time studied. The learners were also invited to attend an open lab (on the fifth day), where they worked independently using a tool called Learner Web, an online learning tool designed to help learners build academic skill while learning how to use the Internet (Reder, Vanek & Wrigley, 2012). Sixty-nine people attended this online learning lab at least once each during the period of the study.

Focal participants. In each class meeting, there were ELLs who required much support in order to make use of learning activities. My method of finding interviewees was based on my degree of interaction with the learners. I determined, during observation, which learners both needed some help and could answer basic questions in English. English language capacity demonstrated by focal participants was adequate for very basic communication, but not close to being considered proficient for most work and educational contexts. As I worked with and interviewed each participant, I estimated their

English language proficiency comparing their interview transcripts to the competencies described and categorized by, CASAS[5.] Table 3.1 introduces each of the focal participants.

Table 3.1

Focal Participant demographic information

Alias	Age	Time in US	Approximate CASAS Level	English class
Abashir	45	4	Beginner	No/Working
Aaden	43	5	High Beginner	Waiting list
Saado	30	12	Intermediate	No/Working

Each of these focal participants were Somali.

Eubanks (2012) found in her study on digital literacy programming and low-income job seekers that many attendees of CBO computer classes actually find themselves in their classes only because they were referred there after seeking other social services at the CBO. Table 3.2 shows why my focal participants made use of all services at Project Ignite.

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[5] CASAS an assessment approved by the US Department of Education, Office of Vocational and Adult Education, for placement and progress measurement in ABE programs. For more information about CASAS competency levels see: https://www.casas.org/docs/pagecontents/eslsld.pdf?sfvrsn=8 and https://www.casas.org/docs/pagecontents/oralleveldescriptors(2).pdf?sfvrsn=6

Table 3.2

CBO services received

Alias	Referral	Digital Literacy Classes	CBO services (# of sessions)
Abashir	Walk-in	Digital lit workshops - 3	Job search workshop (1) Job counseling sessions (3) Transportation support
Aaden	Staff	Digital lit workshops - 2	CBO housing resident Transportation support
Saado	Friend	Digital lit workshops – 9	Transportation support

None of the participants first went to the CBO for computer classes, but upon intake were encouraged by assistance coordinators to attend the workshops.

Data Analysis. Data were analyzed by qualitative coding to find themes important to inquiry about learner identity and investment in these classes. I used first cycle coding identified by (Saldaña, 2012) as descriptive (i.e., labels of the topic of a selection of qualitative data). As I moved through transcripts, audio files, and field notes, I identified relevant themes, resulting codes like *Learning, Computer skills, Attitude, Social capital, Investment,* and *Teacher-centered*. I also integrated demographic data into my coding to better see patterns in the data and to shape observations. Next, I drew on data from online assessments and online learning activities to further inform my understanding of the work of the learners in the program. Finally, I received data from CBO on additional services used by the focal participants to better understand what drew them to the agency and what barriers learners hope the agency would help them overcome.

Findings and Discussion

Broadly speaking, this study provides confirmation that ELLs share the assumption that digital literacy skills are required for full participation in economic and civic life in the US. Specifically, to answer the first research question: *How do adult English language learners' observations about schooling, literacy, and technology use reveal their perceptions of their place in our technological society?* I found the following: (a) learners noticed digital technologies around them constantly as they moved through their day and noted that to fully participate or have agency in our technological society they needed computer skills; therefore, (b) the learners chose the stand-alone digital literacy learning opportunities at Project Ignite over enrollment in formal ABE programs; they felt computer skill develop the most expeditious means by which to support their identity as fully-engaged, technologically proficient adults.

In answer to the second question, *how do adults construct or co-construction their identity through digital literacy learning opportunities and use of computers?* I found that the nature of instruction available at Project Ignite complicated learning and participation. Given the stated privileged status of learner investments in digital literacy, this likely complicated their identities as legitimate participant in the computer lab, as demonstrated by lack of persistence in a multiday workshop series.

Digital literacy as a priority. The learners said they prioritized digital literacy because it was an expeditious means to fully participate in work and English language learning, which was demonstrated in their choice to attend the computer skills workshops and in interview data, where they described the ubiquity of computers in their daily lives. Each interviewee mentioned seeing computers in school, work, banks, shops, libraries, and hospitals. “They all use computers. Everybody now use computers” (Saado, December 10, 2014 interview). All of the participants reported needing to use a computer to study English and had a computer at home; two had residential Internet, one other said that she was trying to arrange it. Abashir, the participant with the lowest English language proficiency, remembered seeing computers in offices in Africa and reported that he had tried to use the computer to look for work at both Project Ignite and at home. He stated that computers were “Everything, everywhere!”

Further, the learners chose computer classes at Project Ignite over the formal English language learning programs in the neighborhood because it offered stand-alone computer classes, without requiring enrollment in language classes, unlike the nearby Adult Basic Education center. For all of the participants, computers were identified as the investment that provided the most expeditious means to reach future goals, as demonstrated in justification they shared attending the computer skills workshop, shown in Table 3.3.

Table 3.3

Digital literacy investment justification

Learner	Reason	Justification
Abashir	Work	Stated that most job search is done online and that many work applications are online. "Work is first. English & computer both important. Work is life. Need to eat."
Aaden	English	Put on waiting list for English classes at local ABE program. Told to study online until there was a space. Building skills to learn informally until and after he starts formal ABE program.
Saado	Work	Had worked for twelve years in US. Stated that her English was proficient enough for her job as a retail cashier, but needed more computer skills to get a better job, study English, and someday go to college. Could not attend formal ABE program because it only offered "full package" (ELL with embedded digital literacy instruction). Work made make it impossible for her to attend.

Each learner in this study saw digital literacy as a tool, one prioritized over English language learning, because it offered a means to succeed with future goals. Figure 3.2

shows their articulated shared route to success.

Figure 3.2 Using digital literacy as capital

The connection between their understanding of the importance of having strong digital literacy skills and their identity lies in the learner's recognition that digital literacy is a form of capital in our society. Norton (2013) observed that learners make investments based on expected future benefit or in the formation of "possible selves" (Markus and Narius, 1986). Her claim was based on Bourdieu's writing on cultural capital, which acknowledged that some social forms have higher social capital than others and are hence perceived to be authentic and that symbolic power is exercisable only when it is recognized by those who possess power (Bourdieu, 1991).

When learners chose to invest in language learning or other learning, they increase symbolic power and material resources that can lead to higher cultural capital. This means that every exchange with target-language speakers potentially shapes a learner's identity and shapes how a language learner relates to the social world. Indeed, the same may be true with respect to exchanges that occur in digital spaces like the Internet. These data show that learners perceived computer skills as essential symbolic capital, without which they were not legitimate members of society (Bourdieu, 1977); hence, lack of computer skills was another means by which their status as "other" was solidified. Even

Abashir, the participant with the lowest English language believed that digital literacy would help him learn the English language and get a job.

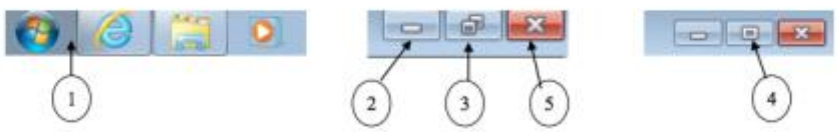
Instruction impacted participation. The structure of the workshops and instructional choices made by the workshop leader were the primary determiner of student experience and learning, so had some impact on learner identity, agency, and skill development. Descriptions of the structure of the learning activities and examples drawn from transcripts and observational notes revealed that instructional strategies created barriers to full participation of ELLs and situated them outside the group of participants able to make use of the instruction. ELLs were othered in this way because the capital they brought to the learning experience was not well aligned with the ideologies and expectations of the teacher, Leanne. This was evident in the following characteristics of instruction: teacher-centered presentations, unscaffolded use of abstract lexical items, over reliance on display questions for comprehension assessment, and little or no wait time. Data illustrating each of these characteristics is included below.

Teacher-centered presentations. The most common learning activities in the computer skills workshops were teacher-centered and highly structured. The workshop leader stood in the middle of a lab with twenty desktop computers and a laptop that was projected on to a large screen hung in front of the room. The leader provided instruction by talking through a seven-page handout (see Figure 3.3), and projecting each click described. The handout contained screenshots and text-based descriptions of the processes required to accomplish the benchmark tasks, and presumably prepare the learners to take the Northstar Digital Literacy Assessment tests. During this time, the students sat quietly, looking between their computer screen, the presentation screen, and the handout, trying to click along with Leanne's demonstration.

MINIMIZING AND MAXIMIZING WINDOWS

WINDOW: Anytime you open a program (like Word, Excel, Internet Explorer, etc), you have opened a window. A window is the way you see a program, file, folder, etc. You can have multiple windows open at once.

Most windows have three buttons in the upper right-hand corner of the screen.



1. **Task Bar** - The horizontal bar on the bottom of the desktop where open programs are displayed. Opened programs will have a box around the program icon.
2. **Minimize** - This button will minimize the program you have open on your desktop. It does not close the program and you can open it back up again on the taskbar. Opening the program up from the task bar is called *maximizing* the window.
3. **Restore Down** - This button will change the size of your window. Pressing this while the window is taking up your entire desktop will make it so that it only takes up a portion of your desktop. This will allow you to move this window to the desired location on your desktop, and to change the size of it.
4. **Maximize** - This button will change the size of your window. Pressing this while the window is only displayed on part of your desktop will make it so that it takes up the entire desktop.
5. **Exit** - This button will close the window which is being displayed.

Figure 3.3 Computer basics workshop handout

Data from observational notes reveal that teacher talk time represented about eighty percent of each of the observed workshops.

The transcript below illustrates how the workshop leader's instruction on files and folders is inaccessible to Aaden, the high-beginner focal participant. Leanne is the TAC member who is teaching, and Jen is the researcher. Note that the excerpt of Leanne's initial speech represents 2:30 minutes, through line ten (and including omitted text). See Appendix B for my transcription conventions.[6]

Leanne You can put files in folders. Just like when you are working in an office and when you are organizing your home files. You often put files in folders. So you make a folder. You right click on your desktop. You get a pop-up menu. So here's the pop up menu I got from right clicking and I'm going to go down to new. And if I hover over new, I get this whole big new set of stuff, so I'm gonna slowly move my mouse across the new and I'm going to left click on folder. Once I do that, a new folder pops up, and it says new folder in blue. If something is written in blue or highlighted in blue (…) [text omitted for brevity]. Word into XXXX's folder, I could, ummm, but usually folders are used for organizing files.

---

[6] My transcription conventions were shaped by finding a balance between representing naturalized, transcription process is highly visible, and denaturalized representations of speech with a more visible transcription process (Bucholtz, 2000, p. 1461). To do this I relied on familiar punctuation conventions to support the organization of utterances. I did not choose closer or denaturalized style because this is not a work of critical discourse and phonological markers did not inform my analysis of participant utterances.

[Aaden is sitting there doing nothing. I approach to check in. Leanne continued to explain how to move files into folders.]

Jen Right now, she is just explaining how to move files around.

Aaden What's a file?

Jen [[That]] [pointing to his screen].

Aaden [[That's a file.]]

Leanne [in the background] [[Does anyone have any questions about folders?]]

(Classroom transcript from February 10, 2014)

The transcript excerpt is a good example of an accessible skill made inaccessible by the instructional format, where the teacher stood at the front of the classroom, talked to the students as a whole, and demonstrated clicks on a projected screen. The entire presentation talk time was nearly three minutes, but Aaden was lost at the first sentence because he did not know what a file was. You can see him ask about it in line fourteen. After Aaden asked his question, I provided some differentiated instruction focusing on vocabulary (initiated in line fifteen), which eventually resulted in his mastery of dragging files into folders,

These data elucidate the challenges of heavily teacher-centered instruction in a digital literacy workshop; in such a structure, differentiated instruction is nearly impossible because the leader is generally unaware of learner comprehension issues. Aaden, Abashir, and to some extent, Saado had trouble with instructions; attending to the navigation cues; and understanding when they were supposed to sit, watch, and listen, and when they were supposed to click along with the workshop leader. For Aaden and Saado, this confusion was resolved once they figured out the task with the help of some additional instruction. The content of the classes was not beyond their proficiency and they were able to complete activities, but for Abashir, the negative impact of this instructional choice was less easily mitigated. Abashir’s English proficiency was so low that he could not comprehend the instruction even with additional support. He was never able to develop proficiency in the tasks because he kept trying to keep up with the pace of the class. This left no time for the amount of practice he required and because his English proficiency was well below that of the rest of the class. He was never sure what he was supposed to be doing, so could not easily advocate for himself and ask for help.

The following transcript excerpt from the same activity shows the teacher pressing ahead, moving on from files and folders when Abashir was completely lost.

Jen OK, so this is what we're doing right now. If you close this and shrink this [pointing to his screen], she just showed you how you can move files around on the computer.

Leanne [[ok so, I'm going to show a quick video on that]] [meaning, more complex features of Desktop] and then we'll move on.

Jen [[This is a file.]] [Abashir points where I pointed]. Ok. That's a file. These are folders. Sometimes you need to put a file in a folder.

Leanne [In the background] [[This video is about a desktop in general and how it's a great organizational tool.]]

Jen [Pointing to screen] [[It's someone's resume, they want to get a job. This is a resume.]]

[Video audible in the background]

[Clicking] OK. This is what the file looks like. Ok, this is what it looks like. Now, I'm going to show you how you can move it around. This is the folder. We want you to put it in there [clicking, Abashir looking very confused]. Sorry A, you can move this into the folder. Actually there's no folder. [A had missed previous instruction to create a folder on the desktop.] Why don't you practice clicking and dragging, moving the file around? Move it around....

Abashir [Practices clicking and dragging document file around on the desktop]

(Classroom transcript from February 10, 2014)

This transcript shows that I am essentially providing parallel instruction, but Abashir and I keep getting further and further behind the teacher's instruction as Abashir required more explanation and support. Unlike in the previous exchange with Aaden, I was not able to support the learner's access to the instruction. Abashir is one of the few learners in the room who cannot keep pace and arguably the benchmarks that define the lesson are so far beyond his language and computer proficiency that they are not accomplishable. I had to change the activity for him to keep him engaged.

This excerpt, along with many others like it, reveals incongruity between the language of instruction and the language level of both the featured focal participants. The language especially excludes Abashir. In another example, he had just barely figured how to locate and use the start button when the leader launched into a complicated description of the programs found on the program list, with little chance to reinforce his skill with the start button or understanding of what all of those programs do. Each of these examples suggests that Leanne's priority is the learners who can keep up or those who can catch on when shown how to do something once, in a decontextualized way.

Vocabulary. Easily noticeable throughout the observation notes was the dearth of common strategies used by Leanne to make input comprehensible to ELLs. With respect to vocabulary, common teaching techniques like think alouds, presenting cognates, or providing embedded definitions (Fitts & Bowers, 2013) might have been tried. A note from one observation reads: *"Terms on worksheet not comprehensible to learner: desktop, taskbar, applications, icons, system tray, start button, programs, etc.* (Observation dated December 3, 2013). Similarly, two later notes show examples of problematic vocabulary used by Leanne in class.

> *"All programs are buried, so I'm going to click All Programs and I'll get a list"*
>
> *"At the top are individual program, so like Adobe reader, which opens PDFs"*
>
> (February 10, 2014)

"Programs" used in the first example is not defined, nor had it been previously defined in the transcript. Further complicating comprehension of this sentence is the idiomatic use of “buried” and the fact that it is in passive form. In the second example “PDF” is supplied as part of a definition of the term program, but it is not itself defined. In the first excerpt above Leanne does try to show by analogy what a file or folder are; however, embedded in the analogy of files and folders in an office is that learners will have had experience in an office environment.

These examples of abstract lexical items suggest a previously unstudied academic language of digital literacy. Lemke (1990) wrote that learning specific academic content meant learning the language used to describe it. Schleppegrell (2004) suggested academic language was characterized by the command of the language used in specific academic contexts. No matter the definition, learner identity and investment in learning is deeply connected to command of academic language, including not only the vocabulary and language structures but also a broader communicative competence accomplished through the support of teachers; hence, providing students an opportunity to practice using language to support acquisition of content skills is essential if they are to feel like authentic participants in the learning environment (Fitts & Bowers, 2013). In order to best support adult ELLs in digital literacy learning opportunities, teachers and tutors must be made aware of these structures and be prepared to scaffold learner language proficiency to make use of them (Fitts & Bowers, 2013).

Display questions. These data reveal that the most common comprehension check employed by the workshop leader was display questions, for example: "How many tabs do I have open?" "Where is the home button?" "How do I return to previous webpage?"

One particularly interesting example occurred as Leanne tried to take an online quiz with the class, attempting to project her browser onto a screen, while students were also trying to load the website. Because the quiz was slow in loading, she resorted to use of display questions instead of potentially formative interactive use of the online quiz.

Leanne	Ok. So, we'll do our own version of the quiz. So, if I have Word open, is that hardware or software?
Class	Software
Leanne	[with class] Software. Aahhh, if I have one of those big system units?
Class	Hardware
Leanne	Hardware because you can touch it, and we don't have those, again, but normal computers have those. Ummm, if I have a laptop is that hardware of software?
Class	Hardware.
Leanne	Umm, if I have iTunes, is that hardware or software?
Class	Software. [Not everyone is audible here. There is lots of mumbling in each of these responses to the display questions].
Teacher	Ok. I think you guys got this down, so we are going to skip this quiz because I think that you have passed it, in my mind.

(Classroom transcript from February 10, 2014)

By asking the learners to skip the quiz and using display questions addressed to the whole group to monitor comprehension, the workshop leader missed an opportunity to see who truly understood the concept. My observational notes reflecting this exchange show that Abashir was not able to participate at all and that Aaden tried to follow along, sort of mumbling during the choral response. Despite this lack of engagement, Leanne decided that the general level of comprehension was adequate for her to skip the more interactive formative assessment included in her lesson plan. She had no idea that two of the ELLs were not keeping up, again situating them as outside the group of authentic participants in the class.

No wait time. Finally, the data show ample examples of general questions addressed to the whole group followed by wait-time of only a second or two. "Any questions?" or "Unless there are any pressing questions, I am going on to page three". The transcript of February 10, 2014 shows an interesting example of Abashir responding to such a question.

1	Leanne	Does anybody have any questions about “speaker” or “all
2		programs”? [No wait time]. I just want to quick go over that, so we
3		didn’t go into any depth but if anybody has any questions, we can
		talk more about it.
4	Abashir	[Inaudible question]
5	Leanne	The what?
6	Abashir	I don’t understand.
7	Leanne	Oh. OK. [Does not answer the question and continues explaining
8		next thing to class]. Now we are going to on the next page. We are

going to talk about maximizing and minimizing windows. Can anyone tell me what a window is when we are talking about computers? [5 second wait]. I will tell you then. Umm so, a Window is…

Jen [Working with Abashir, overlaps with audio transcribed above.] That is how you change the volume. If you want the sound. If you want to listen to a movie or to music, this is how you can change the volume to make it loud or to make it soft. She was just showing you. You are not going to practice.

Leanne had just explained how to adjust the volume of the computer and had asked for questions. Abashir asked her one, which she did not respond to so that that she could return her full attention to full class. This exchange was not optimized to ensure that Abashir and his needs were unmet by the pace of instruction; this serves as another example of the limitations of the teacher-centered computer basics workshops.

Global analysis of instruction in the structured workshops. This analysis informs a response to research question two: *How do adults construct or co-construction their identity through digital literacy learning opportunities and use of computers?* The teacher-centered instruction in the workshops was characterized by inaccessible language, unexplained technical vocabulary, display questions and open-ended general questions rather than any comprehension checks, and a drive to get through the instructional document. Each of these workshop characteristics made it difficult for the ELLs to follow along or learn.

Drawing on Darvin and Norton (2015), it is clear that the potential impact of misalignment amongst the skills or capital brought into a learning environment by the learner and the ideologies that shape the leader's perception of the value of that capital. In such a situation, learners requiring scaffolding for participation and who do not receive it are left outside the group of legitimate learners. In this context, there was much to distance the beginning English learner from the more proficient or first language English speakers, the instructor, and materials used in the workshops. Learners distanced by instructional choices, materials, and content had their current subject positions as non-computer users affirmed; therefore, their investments were unsupported. Angélil-Carter (1997) writes that multiple literacies and discourses are part of L2 learning, and that investment in any of them shapes literacy skills and hence shapes identity: "…not only do subject positions, and thus the ability to claim the right to speak, change over time, but they can change within one encounter" (p. 263). Hence, even one such experience can negatively influence future investment.

Independent learning workshops. One day each week, the computer lab at Project Ignite hosted an open lab. Learners attending could choose from a library of online learning resources linked to from a website called Learner Web. Learners arrived at their convenience, stayed as long as they could, and when ready, took a Northstar Digital Literacy Assessment module. Data from this more learner-centered open lab show fewer potential barriers to investment. Learners present on those days spent much more time on task, rather than time trying to figure out what the task was or just sitting there trying to keep up with clicks. Additionally, the only learners to pass the Northstar Digital Literacy Assessment tests while I was there were attendees of the independent learning workshops. An excerpt from Saado's interview on December 2, 2014 shows her opinion on the two different instructional formats.

1	Saado	I think I learned more today.
2	Jen	When you are independent?
3	Saado	Yeah
4	Jen	Working independently?
5	Saado	Yeah. I need, anyway, I need help. When I need help she is helping all
6		these people [referring to whole group instruction]. She cannot go
7		everywhere.
8	Jen	Yeah.
9	Saado	So it's like, I was doing myself. And I think people who was before me
10		was doing, maybe, better than me. Even though everybody has like
11		question every ten minutes.
12	Both	[Laughter]

With her comments in lines 5 - 6 and 8 – 9, Saado indicated that she did not feel like the target of the whole group instruction, directed at those she perceived to be keeping up. Indeed, my observational notes from these more learner-centered workshop days provide additional evidence that learners received more useful instruction in an independent learning structure.

Table 3.4

Examples of successful independent learning

Date	Issue	Response	Result
11/22/13	Learner not able to follow instructions; did not understand structure of Learner Web	Leanne moved her to a quiet corner; set-up computer basics content on digitallearn.org	Learner able to engage with activities on basic computer information and use
12/2/13	Learner did not understand technical vocabulary; T provided	Leanne saw learner's confusion; repeated instruction with embedded definitions for vocabulary	Saado was able to complete activity and received a certificate
1/24/14	Learners were confused about structure of Learner Web	Leanne gave general navigation overview; we both provided one-to-one guidance when learners had questions.	Learners completed activities of their choosing and passed assessments. Learners showed excitement about their small successes

2/28/14	Learner was confused about how to find next activity	Leanne gave cues about how to close tabs and return to Learner Web to choose an activity.	Learner progressed through an entire lesson and then passed the corresponding Northstar Digital Literacy Assessment.

Most of my notes about this workshop structure are from my observation and work with Saado, who successfully completed several activities and made independent choices about subsequent tasks. At each milestone, she expressed joy at passing quizzes and excitement about the next activity, an activity of her choosing. Saado gained confidence because she was given agency and an opportunity to learn from her errors and the individualized instruction she received. This confidence is illustrated in her remarks about home Internet connection. When discussing the issue in class, she stated that she would need to use a library Internet connection. However, later in the day, during our interview, she stated that she would be getting a home connection so that she could continue her computer practice and learn English online, suggesting some confidence about being able to work independently at home and a commitment to joining the digital world.

This illustration stands in contrast to the examples of the teacher centered instruction employed in the computer skills workshops described previously. The teacher-centered nature of those workshops fell short in several key ways. Firstly, the over use of large group instruction and display questions made it nearly impossible for Leanne to know when the learners were not following along or understanding her presentation. Also problematic was the very high literacy level required to comprehend the text of the handout that she used to control the pace of the lesson. Compounding this problem was the lack of attention to the language development required to support full participation of the English language learners in the workshop. Neither Abashir or Aaden completed all four days of these structured workshops; consequently, neither progressed to the more learner-centered independent learning workshop, at which they were far more likely to receive the individualized support they needed to persist.

Pilot Study Implications & Conclusion

Norton (2013) wrote that a target language community includes “a desired future community that offers possibilities for an enhanced range of identity options in the future” (p. 3). What prioritizes investment, then, is the learner’s perception of the symbolic and material resources that investment will yield and how that will impact their role or place or identity future, imagined communities. For immigrants and refugees with language learning needs, digital literacy, as a component of literacy, becomes part of their language investment and technology is a space for interaction that shapes identity and future imagined communities.

Technology is part of the whole that shapes learner identity because it impacts one’s ability to interact, solve problems, learn, get access to resources (Eubanks, 2011; Gee, 2008, 2010; Jacobson, 2012; Norton, 2013). Digital literacy classes are forward thinking and shape ideas about imagined communities because of the promise they hold for positive impact on future work and schooling. They are the means to reach these imagined communities, so it is critical that that elements of the digital world that other ELLs use to solve real life issues are not replicated in instructional opportunities. Without adequate attention to the needs resulting from lack of a shared (academic) language, low literacy level, and little to no prior computer use experience, learners will perceive that they are part of the community of learners who can achieve digital literacy and their persistence and perhaps even future investment of time and attention are negatively impacted. Indeed, in this study, persistence of lowest English proficiency learners (Aaden and Abashir) in this study was low, that is they did not complete the four-day workshop, nor did the return for the final independent learning workshop held on day five.

In order to create more accessible learning opportunities and support the investment of the learners, new or untrained teachers working in these instructional settings need to have resources available to scaffold their instruction. Such resources might include resources like the Learner Web or other online sites that link learners to self-paced learning opportunities and guidance and resources on how to support the language needs of ELLs in their classes.

Study 1: A Needs Analysis from the Instructor's Perspectives

The pilot study presented above described the instruction provided by an inexperienced TAC member relying primarily on teacher-centered pedagogy, finding that learner persistence would be better supported by adjustments in instructional strategies and classroom management that provided more learner-directed activities. Because so many ELLs are served in similar community-technology labs, this is relevant beyond just the focal participants in the pilot. In order to confirm or contest the issues raised in the pilot study, I needed to expand the needs analysis to consider teacher viewpoints. I, therefore, convened a series of focus groups with four Technology Access Collaborative (TAC) AmeriCorps members, the focal participants of the larger dissertation study. My goal for the next phase of research was to confirm or contest my observations about the challenging aspects of the instructional setting observed in the pilot. I employed the following questions for this phase of the work.

1. What do the participating TAC members suggest are the instructional challenges they face when working with adult ELLs in basic computer skills classes?
2. What resources do the TAC members suggest might be helpful for mitigating the challenges they face as minimally trained teachers?

Including the TAC members in the needs analysis was necessary to ensure that my biases and beliefs were not the primary lens through which their instructional challenges were defined and to support the eventual development of instructional resources truly aligned with their needs.

Theoretical Orientation of this Study

The theoretical framework guiding this phase of the research shifts from the poststructural to a sociocultural lens, the overarching framework for the dissertation. As described in more detail in Chapter 2, Engeström's Activity Theory suggests that learning occurs through action or activity in a given context and that this activity itself is shaped by a range of factors within that context (Engeström, 1999). Because Activity Theory characterizes cultural and situational influences in a given context, it is a useful lens for better understanding the challenges that instructors face in a classroom, particularly as they are mapped upon the components of an activity system defined by Engeström (1999) and pictured in Figure 3.4.

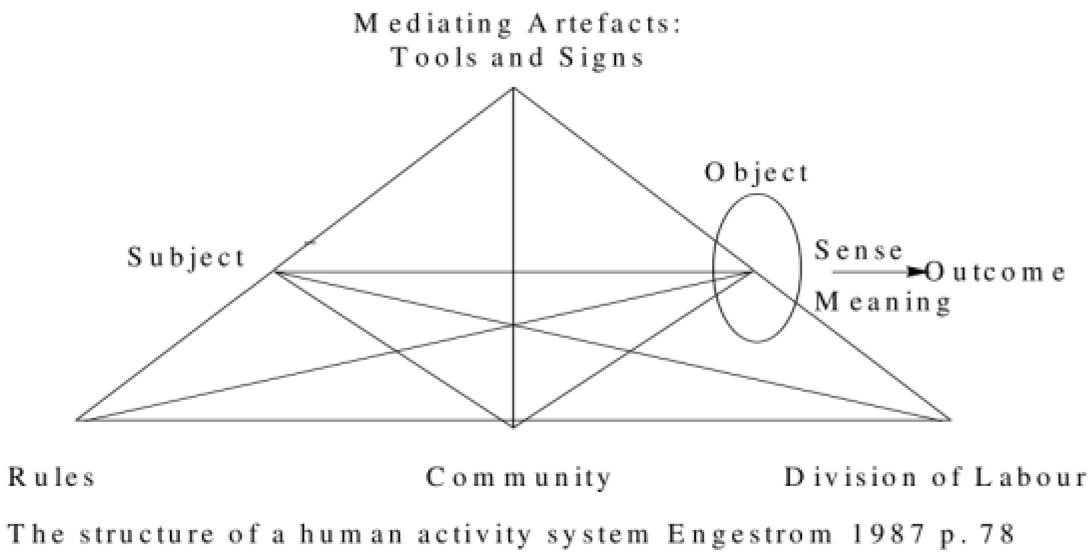


Figure 3.4 Engeström’s Activity System model

Each of the components works synergistically to shape the Outcome, which you can see outside and to the right of the model. Each of the participating sites in my research possessed its own activity system. Within each, the ‘subject’ was the TAC member, the ‘object’ was learners, the ‘mediating artifacts’ included instructional strategies and resources, and the ‘outcome’ was engagement and success in computer skills programming made available. The circle on the model emphasizes the focal point of the activity system, where the impact of all of the other components come together to shape the outcome.

This study was primarily concerned with ‘mediating artifacts’ point of the model; mediating artifacts here were the instructional strategies and resources employed by the TAC members to support learning. It is in this area that my pilot suggested scaffolding was needed to mitigate the lack of experience of the TAC members. As previously described, an equitable balance amongst the three components of Silver-Pacuilla and Reder’s (2008) required elements model must be attained to support successful learning through online technologies. Figure 3.5 illustrates this how this balance might be achieved.

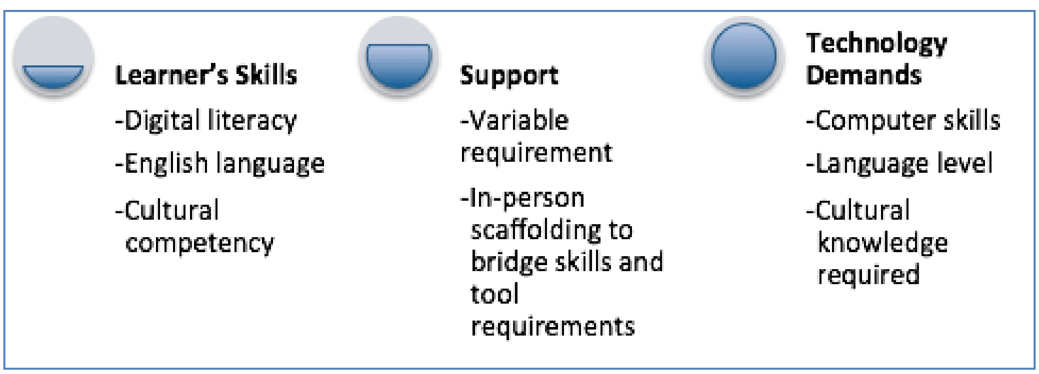


Figure 3.5 Rendering of Silver-Pacuilla and Reder’s (2008) Required Elements Triad

Because learners’ skills are highly variable, teachers can work to increase the quality of support and lower technology demands of instruction in order to reach the broadest community of learners possible. The pilot study suggested several instructional challenges. Development of resources to mitigate these problems by providing quality support and lowering technology demands is the goal of this research; however, before embarking in this work, the assumptions drawn about instructional challenges needed to be put to TAC members, to see if my beliefs were shared by the practitioners in question. Such an approach is required in DBR to be sure that community members who experience a problem are involved in defining the problem and developing a solution to address it. This section, thus, extends the pilot to understand facilitator's perspective of instructional challenges and endeavors to understand how to mitigate them.

Methodology

This qualitative study explored TAC members' perceptions of the instructional challenges they faced and the characteristics of resources they suggested would mitigate those challenges. Data drawn from focus group discussions, where the TAC members shared their beliefs about teaching, were measured against the findings from the pilot study and informed the scope and focus of the intended intervention. The goal of this specific study was to confirm the need to scaffold TAC members preferred instructional strategies and to better understand where their pre-intervention knowledge and strengths laid in order to mitigate the problems caused by their lack of experience working in this context. Findings indicated the challenges observed in the instruction in the pilot study were shared in these contexts and felt by the TAC members to be important areas for support provided by the intended instructional resource.

Sites and participants. Because all of the TAC members introduced in Chapter 2 had volunteered to develop instructional resources on behalf of the entire AmeriCorps program, they all participated in the focus group discussions and subsequent design of the primary resource. However, though all four sites were visited, observation data presented here draws primarily on contributions from the two participants who taught low-level ELLs at Newcomer Home and Ascend. Ascend offered classes to adolescents and adults supporting workforce training and computer skills with the goal of helping community members achieve economic and social stability. Instruction in the computer lab was led by Erik, and characterized by a rolling cohort with very few learners coming every day and no way of knowing who will attend each day. Newcomer Home was a bit different, in that it enrolled ELLs in formal English language learning and provided computer classes to supplement language classes. These computer classes, led by corps member Marty, were several weeks long and supported a cohort group of students that remained largely intact throughout the course, with new students joining in along the way.

Methods. Focus group discussions with the TAC members served as the primary data source. The goal of these conversations was to confirm or contest initial assumptions about the need for resources and strategies to improve instructional experience for both the facilitators and the learners in their labs and to begin to understand how the intervention might begin to take shape. To accomplish this, questions for the focus group drew on the premise that in any given instructional event there is a balance amongst technology, pedagogy, and content knowledge (TPACK). An instructor's awareness of these elements, when applied to instructional choices can support instruction that best leverages them together (Mishra & Koehler, 2006). Questions attempted to draw out the concerns facilitators had about their TPACK awareness and painted a picture of a facilitator's self-perceived experience with digital literacy content, and to some degree, English language content and instruction. A few of the meetings were quite formal with interview protocol set up beforehand. See Appendix C for a list of the focus group meeting questions.

A second informative data source were classroom observations, which were often followed by informal interviews of the TAC member observed. The primary goal of these conversations was to provide support for their instruction, but also provided an opportunity for the TAC members to share observations about the lesson and, more generally, beliefs about teaching and learning. The focus of all observations was to gather data representing instructional challenges and effective strategies. These data are reflected in Table 3.5 below.

Table 3.5

Data collection in Analysis and Exploration Phase

Method	**Focus groups and interviews**	**Classroom observations**	**Presentations**
Number of Sessions	6 sessions	15 sessions	3
Hours transcribed	10 hours	22.2 hours	0

Supporting materials	n.a.	Class handouts, photos of learning environment	Power Point slides

All of the audio data from the six focus groups occurring in the analysis and exploration phase were transcribed. Key instructional moments in the audio recording of classroom data were also transcribed. These data were all uploaded to and organized in the qualitative analysis software MaxQDA for analysis. Taken together these data, plus artifacts and images gathered in the classrooms, provide triangulation required to support findings and also mitigated the possibility of unfounded observations contributing to formation of the intervention.

Analysis

These data were qualitatively coded in a multicycle process in order to examine them in a layered fashion (Saldaña, 2012). All coding was done in MaxQDA. In cycle one, I applied structural codes to the entire data set to narrow the scope of my analysis. I used the codes *Needs* and *Instruction of content,* to draw out data that represented instructional preferences, challenges, and ideas for mitigating actions and resources. First cycle coding also included what Saldaña refers to as attribute codes, used for marking useful demographic information about learners and context, for example: *Student info, Levels, ELLs, Class demographics.* I took a second and, in some places, third pass through these data, still drawing on first cycle codes, for as Saldaña (2012) suggests, "a more attuned perspective" (p. 10), adding more codes as I grew into a fluency of the themes that became evident within. During this phase of coding, I applied descriptive codes and sometimes in vivo codes to flag salient themes. The codes and their sub codes from the cycles of coding are listed in Table 3.6. Note that I combined similar codes for brevity in the table.

Table 3.6

Study 1 Codes observed in qualitative coding process

1. Instruction of content	***2. Needs***
No practice	Specific needs
Student choice	Support for teachers
Process of instruction	Extend learning to out of classroom
Review	One website; Structure; Template
Differentiation	Accessibility; Autonomy;
Using student home language	Differentiation; Flexibility of use
Classroom management	Site design specs; Ease of maintenance
Individual Help	Mobile compatible; Internet access
Cohort model	Affective support; Learner corner;
Flexibility	Recruitment tool; Connect people
Display questions	Vocabulary needed
Activity	Multilingual
Resources	Simplicity; Login debate

Challenge because of ELL	Specifically for learners
Use of Northstar	Customizable, adaptable
Teacher role	Self-access tool; Use tech to teach tech
Teacher centered	Short activities easily accessed
Tech impasse	Need for Northstar
Students teaching	Repetition
Demonstration	Resource evaluation; Relevance
Prioritizing content	Diverse audience; Nascent computer skills

In the table above the two numbered codes are the parent codes, with their attendant sub-codes included beneath each one. A codebook defining these codes is included as Appendix D.

Research Questions. The analysis described above was undertaken to answer the following questions.

1) What do the participating teachers, or TAC members, suggest are instructional challenges they face when working with adult ELLs in digital literacy classes?

2) What resources do the participating teachers, or TAC members, suggest might be helpful for mitigating articulated challenges as untrained instructors?

Findings and Discussion

Overall, these data suggest that the issues observed in the pilot study were evident to some extent in the observed classes and were also shared concerns of the TAC members, as expressed in the focus group conversations and informal interviews. They, too, relied on whole group instruction characterized by teacher-centered strategies. This choice of instruction stemmed from their perception of the importance of sticking to a structured curriculum defined by the standards of the Northstar Digital Literacy Assessment, the assessment tool required by the CBOs that hosted the labs. They agreed that this choice was problematic given the range of expertise and English language proficiency in their classrooms and the challenge of rolling enrollment and open lab workshops. The agreed that it would be beneficial to have some sort of web-based tool to help differentiate instruction and create opportunities for self-paced individual learning. Note I the exemplar data shown below was drawn mostly from the CBO site called Ascend. This is for two reasons; firstly, Ascend was the most similar of the sites to the pilot site, Project Integrate. Secondly, Ascend, because of its loose structure of enrollment and attendance, had the most to gain from instructional strategies designed to mitigate the problems observed in the pilot study. In the sections that follow, I share the data that led me to the finding described above.

Instructional challenges. Classroom observation and in person communication from both focus groups and informal interviews generated ample data on which to base findings in response to the question: *What do the participating facilitators suggest are* *instructional challenges they face when working with adult ELLs in digital literacy classes?* I combed through transcripts looking for consistent use of instructional strategies and the resources employed to carry out that instruction. I also flagged any instructional challenges that were represented in these data. The result of this analysis are 16 codes and their frequencies (totaling 285 applications) generated by MaxQDA and represented in Table 3.7 below.

Table 3.7

Frequency of codes marking instructional issues

Name	**Frequency**	**Percentage**
Classroom management	125	43.86
Activity	21	7.37
Resources	17	5.96
Challenge because of ELL	16	5.61
Tech impasse	16	5.61
Demonstration	15	5.26
Display questions	13	4.56
Prioritizing Content	12	4.21
Process of Instruction	11	3.86
Differentiation	10	3.51
Teacher role	7	2.46
Using student home language	5	1.75

Flexibility	5	1.75
Students teaching	4	1.40
Student choice	4	1.40
No practice	4	1.40
Total	285	100.00

Closer analysis of the data associated with the first code, *Classroom management*, makes visible the shape of the instruction and the attendant roles of the participants. This code consisted of two contrasting sub codes: *Individual help* and *Cohort model*, defined as instruction provided to an individual student or to a cohort including as many of the whole group as possible. Table 3.8 shows the number of times these codes surfaced in the data analysis.

Table 3.8

Number of instances in data reflecting instructional strategies

Instruction of content\Classroom management\Individual Help	Instruction of content\Classroom management\Cohort model
69	38

These data show that there is a reliance on providing instruction through individualized help; which, considering the broad range of skill and language proficiency makes perfect sense. This, at the surface, would not seem to reflect an instructional challenge; however, diving more deeply into the data, it appeared that this mode of instruction was not necessarily planned. Rather, individualized help was provided in reaction to challenges faced when the TAC members tried to move through planned lessons intended to be whole-group in nature. Observation notes describing classes observed across the sites show that they were generally planned to support the following process:

1. Individual work as students streamed in. Generally, if available, this was typing practice.
2. Introduction to the work of the day and instruction provided to whole group and supported by demonstration, projected Power Point slides, or other visual resources.
3. Independent work or practice on the instructed content.
4. Process repeated with a new focused skill or subskill.

An analytic memo from data analysis of classroom observation data recorded on June, 8, 2016 gives a picture of what this preferred group or cohort model of instruction looked like.

> *Erik has slides showing key vocab for computer basics. He moves in and out of whole group instruction as he introduces each slide. As he shows things, learners then match them on their worksheet, or write in the name. He goes through the whole sheet with the class and then toward the end of the lesson, he starts moving to demonstrate skills on the actual computer, to follow up and reinforce instruction when they get to desktop.*

In this exemplar description, the instructor attempted to lead the whole group through the materials at the same time. Similar data showing a preference for whole-group instruction appeared throughout the analysis and exploration phase. On several occasions, though Erik knew the learners present had varied prior exposure to the concepts, he kept everyone in a large group. The result was that newcomers had insufficient time with the new content and the students who had been there previously perhaps received explanations that were not needed.

The reason there are so many *Individual help* codes is that this preferred strategy broke down frequently. As will be shown below, instructors were pulled out of their large group instruction so often that these events became the more salient aspect of the instruction and were, therefore, coded more frequently. These interruptions were caused by the diverse range of skills of the learners and the chaotic nature of the attendance in the labs. This contrasts between what was planned and what was possible frustrated both the TAC members and the learners.

Multiple-levels disrupting cohort-based instruction. The learners attending the workshops at Ascend, especially, were multilevel in both English language proficiency and prior computer experience. Consequently, the handout supporting the instruction described above, and pictured in Figure 3.6, only worked for some of the students.

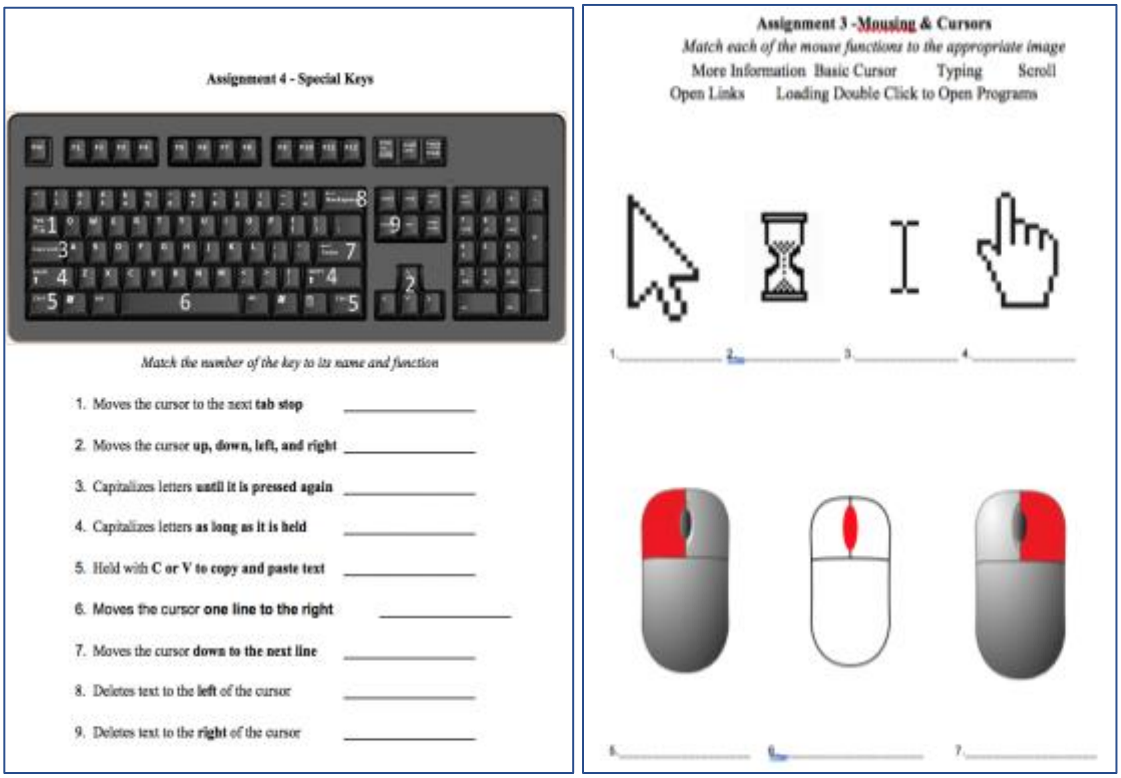


Figure 3.6 Worksheet used in Erik's lesson (front and back)

These worksheets were used during Erik's entire service year; he intended them to be a resource for guiding whole group instruction in class and for review at home. However, the language level was too high for several of the learners I observed in his classroom. Erik was aware of the limitations of planning whole group lessons in a class and using these materials with such a widely diverse group of learners. In an analytic memo written during analysis of the June 8, 2016 observation, I wrote, *"Here Erik describes the flow of his class sessions in a way that makes it clear that he understands he needs to find an alternative to cohort model and his preference for needing to be there for every learner* *every minute."* The memo summarizes a tension felt by Erik as he tried to support his diverse study participants. This tension is also evident in our discussion after the class.

Erik One of the challenges has been that as new students come in I have to give attention to them and then the people when they don't have something new to do start working on Northstar [the assessment].

Jen Yes.

Erik And then they're doing Northstar tests they aren't ready for. So the challenge number one, which is the long-term students are beyond the curriculum I've planned for [in any given topic] and because I've been going 100% for so long I haven't had a chance to get new curriculum for them and so a lot of them have been here for four weeks now and I don't have anything else but I don't want to lose them because they still want to learn and there is still a lot of material to cover it's just I'm focusing on the beginning stuff.

Jen Yeah

Erik So that is one of the challenges of a rolling cohort, but I wouldn't do it another way because in this community, people don't really come strictly at 1PM and I'm not interested in enforcing a strict show up at this time and I've noticed that people have started to come in waves. So if we weren't as busy as we were today would have worked really well - where people who have been coming for a while were early and the people who need to start fresh come later …

(Transcript from informal interview with Erik, June 8, 2016)

In the first few lines, Erik noted the challenge of working with learners who were coming in with different levels of expertise and having covered different content in the class. He noted, in lines 15 – 16, that his planned routine would have worked better if there had been few learners who could come at assigned times, but he also noted that he has an open lab, which he calls a “rolling cohort” on line 12, flexibility his is committed to sustaining. Later in the month, there is an excellent example of Erik struggling with cohort-based instruction, when despite knowing learners’ their past attendance and learning needs, he pushed an unprepared learner into the group.

Erik Ali if you’re ok with jumping ahead a few lessons, I think three of us have been working on Excel so we can jump into a lesson with Excel, so this will be probably two weeks [from now]. But we can come back and do some other stuff after. We can try making a list and a budget on Excel. Those are the next things we’re going to do, because I know you two are hoping to move on to the next part.

So [speaking to Ali] the three of them have been coming for about two to three weeks now, and so they have covered the beginning material and so I was saying you can either jump forward to where they are and then you can come in and we’ll work on parts like these sheets earlier. Does that sound good to you? It doesn't necessarily have to go in order. You'll still understand, I think, a lot of it.

(Transcript from classroom observation, June 08, 2016)

Erik let "Ali" know that even though he had missed the two previous lessons, he was going to join in with the other students, so that Erik could lead a teacher-centered large group lesson. In this case, the shift required Ali to move into an Excel formatting activity, applying basic Excel skills learned by others in the previous weeks. This reluctance to abandon a cohort-based model of instruction unnecessarily complicating the learning experience for Ali, who was not at the same level as the others in the group.

Chaotic environment with fluid attendance. Use of a cohort model for delivery of instruction was also complicated by data I coded as *Chaos*. In my analysis memo from minute three of the audio date from class observation done on April 4, 2016 this chaos is evident. *"This clip is a good example of the chaos often evident in Erik's lab. Lots of coming and going. Busy place. Car alarm blaring in background. Door buzzer ringing as students trickle in. Phones ringing. Very hard to focus here."* An excerpt from field notes from classroom observation at Ascend on June 08, 2016 shows more evidence of fluid learner attendance, resulting in a chaotic environment.

> *3 students at start of class: 2 Somali men, 1 Somali woman (all over 40), 1 Somali woman arrived 30 minutes late...* [abridged for brevity]. *Had them doing typing and NSDL* [Northstar Digital Literacy] *assessment while others trickled in. 3 students are back to learn more about making calendars using Excel, 1 student, Ali, is new to the calendar activity. Ali, arrived on time, but had to leave to pray five minutes into the lesson. The two other students left ten minutes later, all men leaving to pray. There were no students for a few minutes. Three more women come in at 1:45. All had previous experience using Excel. Others joined later.*

> *OBSERVATION: I'm not sure a teacher centered class is going to work. Need to try to work out a system that is more flexible. People coming and going; leaving for prayer. 3, then 2, then 5, then 9 learners coming and going.*

The challenges that Erik faced in his instruction are somewhat different from what Leanne had faced in the pilot study. In her lab, she had more structured start and stop times and a very diverse community of learners who were challenged by teacher-centered large group instruction that failed to address individual learner's needs. Erik was challenged by fluid attendance and a community of very low literacy ELLs. Though his problems were different, a shift to more independent, planned self-directed learning opportunities would have better supported his learners, too. Indeed, the struggle to stick with a cohort model with absolutely no formal cohort was exhausting and frustrating for Erik; abandoning the strategy would have helped him, too.

Using a website to mitigate challenges. In any setting that supports ELLs, instruction needs to meet needs of the students who speak different languages, have different skills and experience, commit to different frequencies and duration of instruction. An option for responding to these challenges that seemed to work in the pilot study was the provision of differentiated instruction that occurred on the last day of the workshop series and structured in an online learning environment called Learner Web. The TAC members from this study, too, realized that they could benefit from an approach of organizing a range of resources useful to a broad audience of learners in one central location. This appears in the focus group data as early as February, 26, 2016.

1 Erik I feel like there'd be a big advantage to having consolidation [of
2 resources on one website] because we probably spend five minutes
3 getting everyone up to a typing website just because there are some
4 many steps that we're going to cover but typing needs to come before
(…)
5 Jen So do you have one big website that everything is linked from?
6 Erik Nope, not yet. I've thought about doing it but I haven't.

(Focus group discussion transcript from February 26, 2016)

Three of the participant TACs had some digital resources in place by that time; John from the Library Lab had launched instruction from folders that he kept on the computers in his lab, Donna from Global Institute, had the intranet of the CBO where learners found materials in files and links to websites on filed documents. Marty was using a simple website to support her instruction. When asked about it during the same focus group, this is how she described it.

1 Marty The Weebly site also launches into skill tutor, which is a site that
2 Newcomer Home students use to practice English skills, math, science
3 literacy things like that. I have log in codes for GED students to practice
4 GED for free. I have some YouTube stuff for beginning students to talk
about money.
5 Jen So how often do you change these resources?

Marty I update these quarterly by going into the backend of my Weebly site. So [demonstrating].

Jen So it’s five resources.

Marty And I usually only keep about four or five buttons on the page. (…) Weebly is free to use. You do need to have a Weebly.com domain name. Your students will laugh when you say “Weebly”. It’s kind of a funny name

Jen So, Madison do you have learners working independently on this or is it constructed to support the flow of your face to face instruction that you do as a cohort?

Marty This supports my face to face instruction, so for example, on a day when we’ll be doing independent work, I’ll usually structure one of every two weeks, so instead of Northstar testing date we’ll do an independent work day and I have my students work on typing practice, Skills Tutor or doing some math and science work. Depending on what level they’re in or if they are beginning students, they might listen to a money song or listen to a song practice their sounds, their alphabet. So, I’ll direct them to the Weebly site and them direct them to the levels, the levels are typing at the beginning, which is for everyone, so yellow is for everyone, and they get more challenging as they go down.

(Focus group discussion transcript from February 26, 2016)

Marty's description of her work using Weebly was a catalyst for the others to move forward in thinking about working together to create a website that could help all the TAC members serving in CBOs. Field notes from April 14, 2016 include a description of Erik talking about how such a website would benefit his program.

> *Erik talked about whether or not the tool could move more people to his class. He also acknowledged feeling tension about how much structure the resource should provide. He needs to account for people not coming and starting at different times but also needs to have some sort of structure so he can use it as a classroom tool. Erik this needs to be a tool that can support classroom processes, for use in the classroom with learners, but also for use after class "train for on-site" use with new learners*.

Later in the dialog they acknowledged the differences in the TAC member sites and agreed that the same resources would not work for all learners; they decided to design a flexible template.

Donna It's a template

Jen So, we are designing a template that curated resources get published in?

Marty I picture something kind of porous when we just drop in like…like I'm seeing like cheese with holes and each of the holes we drop our typing website on, North Star practice, our linked to or GED or Skills Tutor or Khan Academy and a link to mousersize or whatever and that you know we will choose, and the template is taught to each CTEP to use that.

(Focus group discussion transcript from April 14, 2016)

Characteristics of the template. Over the course of the phase of exploration and analysis, there were ample opportunities for the TAC members to discuss their preferences for the template elements and design characteristics they hoped to include in the website they planned to build together. The data from the observations and focus groups were coded to signal these preferred characteristics. These codes and the frequency with which the occurred in the coded data are shown in Table 3.9

Table 3.9

Preferred characteristics for a website

Code	Instances	Percentage
Support for teachers	9	8.57
Extend learning to out of classroom	7	6.67
One website	6	5.71
Accessibility	6	5.71
Differentiation	6	5.71
Site design specs	5	4.76
Mobile compatible	5	4.76
Affective support	5	4.76
Resource as recruitment tool	4	3.81
Vocabulary needed	4	3.81
Multilingual	4	3.81

Simplicity	4	3.81
Autonomy	3	2.86
Customizable	3	2.86
Self-access tool	3	2.86
connect people	3	2.86
Ease of maintenance	3	2.86
Repetition	3	2.86
Use tech to teach tech	2	1.90
Structure scaffolds skill development	2	1.90
Diverse audience	2	1.90
Flexibility of use	2	1.90
Resource evaluation	2	1.90
Relevance	2	1.90
Need for Northstar	1	0.95
Specifically, for the learners	1	0.95
Internet access	1	0.95
Structure	1	0.95
Nascent computer skills learners	1	0.95
Short activities easily accessed	1	0.95
Template	1	0.95
Learner corner	1	0.95

Login debate	1	0.95
Adaptable	1	0.95
Total	105	100.00

Support for teachers. The codes that appeared most frequently, *Support for teachers* and *Extend learning to out of the classroom,* and the high-frequency codes, *One website* and *Differentiation,* touch on the purpose for the website and how the TAC members intended it to impact their work with learners. This is suggested in a comment made by Marty in the April 14, 2016 focus group.

Marty Learners who have lots of barriers and responsibility, who cannot come to class or come to class very often. Need but also need to be able to support short exercises and activities useful anyplace anytime

(Focus group discussion transcript from April 14, 2016)

The except indicates Marty's preference to provide learning opportunities for learners to work at home. Later in the transcript Marty discussed how such a resource could also support teachers by embedding in adequate structure and activities so that learners could work autonomously enough to get adequate practice, more practice than would be possible if restricted to teacher led classroom activities.

Marty So, when I think of something that can help build and support my use of technology, I think of repetition and autonomy. I need something that my students can repeat enough times that they know what kind of keystrokes

4 they are making and why they are doing what they are doing causes the
5 next thing to happen? So, for example the control alt delete sequence I
6 don’t know if we have gone over that in class but my students know
7 control alt delete makes the log in screen happen and that is going to
8 happen every time they hit control or delete. Every time you hit the red X
9 in the corner they know that the page is going to be down and that you can
10 close your computer and class is over. So that kind of reputation helps
them become more autonomous.
11 Jen So the environment needs to allow for reputation and autonomy?
12 Marty Yeah, the environment needs to be clean enough and I think we kind of
13 touched on this when I was observing Erik’s class but we talked about
14 when they are typing websites and how it was so clean. It was just a bank
15 page with just a keyboard and you watched like blue waters come up and
16 you typed those others no ads, nothing happened. And it was just so clean
17 and I thought that was like a beautiful interface Nothing could distract you
18 so you just type and then you click the red X to close and I think that
19 could be something we could really follow that model, so I think that kind
20 of technology would really need in my classroom.

An excerpt from the same transcript shows Erik describing how such a resource could support his learners, both in and out of class.

Erik I’ve been thinking of it in two ways I think, one as a tool for efficient class management, classroom like process or like the way that instead of … It consolidates a lot of information into one place and it allows someone, for example when I want someone to go home to practice their Northstar assessment and practice typing, giving them separate websites is in some ways less advantageous at the beginner stage. It would be nice to give them one perhaps simple URL that they can enter and then access things from that and then we can train to one tool rather than training two 10 tools.

(Focus group discussion transcript from April 14, 2016)

These data also suggest that the website would be useful for the programs that had higher-level and first language English speakers as students, Library Lab and Global Institute. The learners in these sites tended to be able to attend to and make use of the lessons but needed a resource for extra work at home.

These findings were also supported by the coded data that appeared lower in the list, particularly *Structure scaffolds skill development, Diverse audience, Flexibility of use*, and *Multilingual.* The themes from the data suggest the ways that a designed intervention or support for teachers could help in moving away from the teacher-centered model and be replaced, to some extent, with learning opportunities more in line with the diverse needs of a diverse student audience. In this way, the website could provide some structure but help teachers move away from singular pedagogy that relied on strong English language literacy skills and a very controlling instructional role.

Additional guidance for development of the site is evident in high-frequency codes reflecting how priorities presented above might be embodied in its design: *Accessibility*, *Simplicity*, *Autonomy*, *Specifically for learners,* and *Nascent computer skills learners.* As described previously, these data show that the TAC members viewed use of one website to connect learners to learning activities as a means to support in class differentiation of instruction and out of school use. For both purposes, the website would need to be *Accessible* and manifest many of the other characteristics listed in the high frequency codes. Essentially, the site would need to strike a balance between relying on web-based resources for instruction and the limited computer skills of the users. Therefore, it would need to be clearly laid out and easily navigated, maximizing clean design to make it possible for new computer uses to find and then make use of it.

Implications and Conclusion

This list of codes drawn from the focus group and observational data, therefore, became the primary informant of the first design of the website. The employment of these characteristics and elements to develop the website is the focus of Chapter 4. Together, these data show that the assumptions I made after the pilot study about the need to move toward instructional strategies other than teacher-centered large group instruction are shared by the corps members. They acknowledged that it was challenging to be drawn into provision of more individualized support when having planned for and created materials to support large group instruction and that instructional support in the form of a venue for providing self-accessed learning resources could mitigate this challenge.

Bringing this research back to the theoretical framework that supports it, Enstrom's Activity Theory, these findings suggest that, for this group of participants, a focus on the "mediating artifacts" segment of the Activity System model could work to mitigate the other constraints created by their instructional environment. These data confirm that from the subject perspective, here the TAC members, there is a need for resources to scaffold their instruction and that this resource should be developed and employed with the goal of moving away from teacher-centered instructional strategies. Attending to the mediating artifacts, or creating a website to organize instructional resource could help them support the outcome of ELLs developing computer skills.

CHAPTER 4: DESIGN AND CONSTRUCTION (STUDY TWO)

This stage of DBR documents the construction of the first iteration of the website intended to support Technology Access Collaborative (TAC) members working with English language learners (ELLs) in basic computer skills classes. It fits into McKenney and Reeves (2012) Educational Design Research (EDR) cycle ‘design and construction’, the second micro-cycle of the first meso-cycle, which encompasses the research as a whole, as illustrated in Figure 4.1.

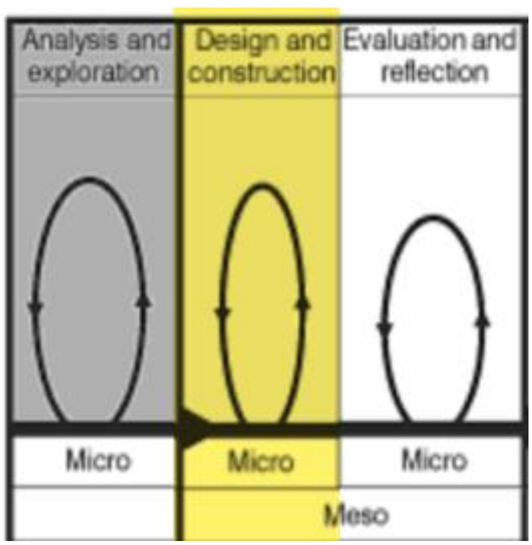


Figure 4.1. EDR Cycles (Figure 3.4 in McKinney & Reeves, 2012, p. 78)

The purpose of this phase in the EDR cycle is to arrive at an intervention that addresses the problems identified in the exploration and analysis phase (hereafter referred to as the needs analysis). In this case, the instructional challenges identified previously, in Chapter 3 are as follows:

1) the TAC members’ preference for tightly controlled instructional strategies (i.e., teacher-centered large group instruction)

2) characteristics of the instructional setting (e.g., learners coming and going, lack of formal enrollment, and noisy disruptions from phones and the door buzzer)
3) widely diverse learner audience.

The major findings of the needs analysis, which reflect a response the challenges were:

1) TAC members needed a resource to scaffold their instruction in order to provide differentiation that the setting and learners demanded
2) the resource should be a clearly laid out website that linked to relevant external resources
3) the website be developed and employed with the goal of moving away from teacher-centered instructional strategies and embed opportunities for development of key vocabulary.

These findings from the needs analysis align well with literature describing how to support adult learners with digital literacy, which collectively suggest that educators need to provide instruction that is adaptable depending on diverse needs of learners (e.g., Jacobson, 2012; McCain, 2009; Moriarty, 2011; Norton & Williams, 2012). Further, it is essential for programs to choose learning resources and activities that are not culturally inaccessible or ineffective for learners not part of the dominant language culture (Garth-McCullough, 2008). However, within a very decentralized system of learning opportunities for adults with basic skill development needs, there is a range of resources and expertise available (Eubanks, 2011; Jacobson, 2012; McCain, 2009; Petty, 2005). This reality can impact the degree of support that learners can access the level of support required to attain balance amongst their skills and the demands of a task (i.e., find equitable distribution amongst the three components of the framework for action of this study, Silver-Pacuilla and Reder's (2008) required elements triad described in Chapter 2). Because learners need access to carefully facilitated differentiated instruction that makes use of culturally relevant and accessible materials, teachers, volunteers, and AmeriCorps members working in CBO sites need guidance on the language of instruction, how to choose effective instructional materials, how to scaffold instruction where necessary, and how to make materials accessible to learners.

Hence, the TAC members engaged in the work of designing and building an easily customizable website that provided access to relevant resources. They chose to develop the site into a template that could allow for flexibility of use across different settings, but that would provide ample structure to support differentiated instruction. The website could, therefore, mitigate a potential lack of support caused by the inexperience and lack of training of the TAC members because it essentially provided an infrastructure for differentiated instruction, creating an alternative to teacher-centered pedagogy. The development of such a website is the focus of this chapter.

DBR

As discussed in Chapter 2, DBR is a research paradigm or participatory methodology through which an instructional resource is developed to solve a local problem while simultaneously contributing to knowledge about teaching and learning (Barab, 2004; Design-Collective, 2003; Hoadley, 2004). It is also known by other names, including Educational Design Research (McKinney & Reeves, 2012) or design experiment (Brown, 1992; Collins, 1992), which represent different approaches to conducting research, emphasizing either educational context or more positivist experimentation. Such variation is the result different epistemological perspectives of the disciplines employing design research and stems from different responses to criticism of the approach. To make clear the motivation for the approach employed in this work, I will first describe common criticisms.

Common Critiques of DBR and Efforts to Mitigate Shortcomings

Between 2010 and 2013, there was a wave of published critiques of DBR which largely focused on methodological and epistemological issues (e.g., Anderson & Shattuck, 2012; Fishman et al., 2013; Ormel et al., 2012; Reimann, 2011; Walker, 2011). These criticisms dated back to the earliest literature (i.e., Brown, 1992; Collins, 1992), when design experiments were situated in the epistemological space between positivist and descriptivist approaches to educational research. Those with a positivist perspective expressed concern with the validity and reliability of educational research done in naturalistic settings. More recent criticism added complexity to this criticism by bringing in the issue of scalability and sustainability, the extent to which DBR inspired resources or interventions remain in place and useful after the researcher leaves (Fishman, et al., 2013) and continue the discussion on whether it is possible to develop useful theories when an attendant goal of research is addressing a very local issue by building a locally useful intervention (Cobb et al., 2003; diSessa & Cobb, 2004; S. McKenney & Reeves, 2012; Reimann, 2011; Walker, 2011). I have made choices in the present study with these critiques in mind, specifically in validity and reliability, with the goal of describing the work of resource development that is thickly descriptive and transparently reflects assumptions about what the design teaches us about teaching and learning. I will touch on these critiques and my responses to them below.

Validity and reliability. Much of the early criticism addressed issues of validity and reliability stems from a reaction to the seminal DBR work of Ann Brown (1992) and Collins (1992). Both moved research on education resources from controlled lab environments to naturalistic settings. Critics contended that it was impossible to control variables in naturalistic settings (e.g., classrooms), which decreased both validity and reliability of a study (Barab & Squire, 2004; Collins, 1992; Hoadley, 2004). Brown (1992) responded to a particular concern about whether her work contributed to a Hawthorn[7] effect, explaining that lack of control was in fact her intention. Basing research in a naturalistic setting was important, she said, because interventions could be viewed *in situ*, subject to all variables of a real classroom. She addressed these critiques

[7] Hawthorne Effect, as described by Brown (1992), is the observed tendency of the presence of researchers to produce a desired effect simply because there is attention focused on the subject's well-being or learning. The principle of the Hawthorne Effect was conceived to account for lack of control in experimental research observed when workers in a factory increased production whenever there was a change in the lighting, regardless of whether it was increased or decreased.

by suggesting that lack of control in situ could be balanced with experimental development of interventions in controlled lab environments, where the two research environments could work to complement each other. Much later, Hoadley (2004) provided a response to potential criticism about inability to control variables writing arguing that because the researcher work on all tasks of a DBR project (i.e., theory development, design, implementation, and evaluation) they can be fluent on all aspects of the project, which “encourages a greater degree of methodological alignment” (p. 205). DBR researchers can, therefore, react systematically to unforeseen events, develop an intervention that best fits the naturalistic setting, and understand how and why the intervention worked.

Cobb et al. (2003) recommended making public detailed records of the ongoing design process and accounts for how understanding of the initial problem changed while the actual experiment designed to mitigate it is in progress. This includes data on learning and "the means by which that learning was generated and supported" (p.12). Such records overcome criticism of validity and reliability by making the research process transparent. Additionally, they recommended multiple sources of data to be sure findings and analysis remain rigorous and empirically grounded.

Data deluge and scope. A related issue or criticism concerning validity and reliability is data deluge, the enormous quantity of data that can confound analysis and contribute to the Bartlett Effect[8]. Collins, Bielaczye, and Bielaczyc (2004) made the observation that DBR researchers

> collect large amounts of data, such as video records of the intervention and outputs of the students' work, in order to understand what is happening in detail. Hence, they usually are swamped with data, and given the data reduction problems, there is usually not enough time or resources to analyze much of the data collected (p. 19).

Similarly, Anderson and Shattuck (2012) suggested that because DBR required multiple iterations it is hard to know when the research is completed. Collins et al. (2004) proposed a solution to both problems by recommending that researchers make use of a structure for organizing and sharing data, a practice that might grant permission for use of more limited subsets of data within many discrete studies and expand the team of researchers who might contribute to making sense of it.

Researcher bias. There is reference in the literature to issues of reliability and validity caused by possible bias created when researchers participate in the design and implementation of the intervention (Barab & Squire, 2004; Zheng, 2016). Citing Cobb

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[8] Described by Brown (1992) as a problem of choosing research points from the data in order to illustrate an intended point. The effect was observed in Bartlett's (1932) study of systematic changes in memory. Bartlett had predicted that changes in recall would depend on participant prior knowledge/experience as learners were as to memorize content of the stories. This was supported in findings; however, later analysis showed his findings were the result of selective use of data to prove his point.

(1999) Barab and Squire (2004) argued that they tried to address this issue by making explicit how issues that come up in the naturalistic context were accounted for in design and subsequent theorizing. They wrote,

> the recursive patterns of researchers' framing questions, developing goals, implementing interventions, and analyzing resultant activity" allows for knowledge to be produced. Hence, accounts of researcher's intervention iterations become opportunities "to examine core theoretical issues and explore learning (p.10).

Rather than corrupting the research context, these accounts are windows for learning more about the issues that emerged during design and provide for the development of effective instructional models. So, contrary to critique about how intervention by a researcher limits utility of theory, it actually helps make the theories that result from design more relevant. Barab and Squire went on to suggest that adequate attention to sound methodological practices found in qualitative methods generally (referring the reader to see Glaser & Strauss, 1967; Lincoln & Guba, 1985) could mitigate limits to credibility.

Generalizability and theory development. Critiques about generalizability have been evident in the literature since Brown (1992) wrote that desired outcomes in one setting will vary for different researchers and teachers in another setting, therefore generalization is not really useful or possible. Most recently, Zheng (2016) wrote that findings in DBR are limited to the context of the intervention because the design of that intervention is so contextualized in nature. In response to similar critiques, Reimann (2011) suggested that generalizability need not be a goal of DBR if the goal is to provide an empirically derived understanding of theory in a particular setting. However, to make it possible for others to benefit from the observations of a study, it is critical that researchers develop a habit of documenting the process of design, so that there is some possibility of replication. Hoadley (2004) and Ormel et al. (2012) concurred that more space be allotted to descriptions of design, guiding theories, and context. Orme et al. considered this “essential to advancing design (research) methodology, as well as allowing research consumers to assess the usefulness of others’ work for their own situations” (p. 982).

An alternative solution provided by Barab and Squire (2004) centered on how theory was constructed; they recommend that theories be flexible enough to account for local particularities and personalities. They suggested that rather than worrying about creating research contexts devoid of “all confounding variables”, local adaptability be built into resulting theories. Indeed, they suggest that theory generated in naturalistic settings with many confounding variables “is supple enough to maintain its robustness even in the context of changing situational variables” (p. 11).

Kelly (2004) wrote that theory generation in educational research requires describable and replicable structure if it is to be viewed as valid by policy makers, for whom randomized controlled field trials are the gold standard. This preferred research is viewed as ‘research’ because it employs ‘scientific’ methods as guides for process and data analysis (Kelly, 2004). Conventions of randomized control experiments provide a familiar argumentative grammar that supports replication of a study in multiple contexts.

Kelly suggested all educational research should be able to point to its argumentative grammar if it is produce finding that are generalizable or inform theory development that is relevant across contexts. Kelly asked these questions about the body of DBR research published up to that date:

> What, therefore, is the logos of design studies in education? What is the grammar that cuts across the series of studies as they occur in different fields? Where is the "separable" structure that justifies collecting certain data and not other data and under what conditions? What guides the reasoning with these data to make a plausible argument? (p. 118).

Reimann (2011) agreed that DBR needs to attend to its argumentative grammar, the logic or rationale supporting reasoning about data. Reimann suggested that DBR draw its argument from qualitative studies. Rather than trying to offer causal-oriented explanations, it needs to rely on "the logic of process-oriented explanations" which present explanations in term of "events and their order" rather than the relationship between variables (p. 43). This is made possible by analyzing the sequence of events that contributed to an intervention, both the design and how implementation impacted different iterations. This is, according to Reimann (drawing on Abell, 2004) is action causality, causality resulting from changes in an environment that are enacted by human actions. So, what does an argumentative grammar of research that strives to demonstrate action causality look like?

Conjectures as argumentative grammar. The work of Sandoval and Bell (2004) and Sandoval (2014) provide such an argumentative grammar in the form of DBR inquiry that begins with conjecture, "a theoretically principled idea of how to support some desired form of learning" (Sandoval, 2014, p. 21). Conjectures craft connection between the design or implementation aspects of DBR to theories, both those on which studies are based and those that are created or extend as a result of the design research. Conjectures are theoretical statements that can be embodied in an instructional strategy or some other designed intervention. When describing the impact of actual design, these are called design conjectures, which articulate "the ideas a research team has about how embodied elements of the design generate mediating processes [observable interactions and artifacts]" (p. 22). By using conjecture, I hope to mitigate the challenges of education research in a naturalistic setting by starting with theories to guide the work and then describing any aspect of the design and building components of the research that extend them or suggest new knowledge on teaching and learning.

Specifically, I have relied on Sandoval's (2014) conjecture mapping approach to DBR, which has guided much research. Recently, Brown & Crippen (2017) employed it a design study based on creating professional development supporting culturally responsive pedagogy in science education, and Wozniak (2015) used it in her study that resulted in the development of an online orientation module designed to prepare university students who were new to distance learning succeed in their online classes. Sandoval writes that a conjecture map can serve two purposes. Not only does it provide an argumentative grammar, specifying the connection between theory and design, it does this by providing structure for simultaneously developing a locally useful resource while building knowledge on teaching and learning.

Theoretical Framework

DBR studies are grounded in theory and work toward generating theory. diSessa and Cobb (2004) provided one of the most sophisticated accounts of theory in DBR literature. They described an approach to looking at theorizing based on an "orientation on central versus peripheral concerns" (p. 79) where theory and theorizing guide decisions on multiple levels. Rather than embracing adoption of grand theories, like "Piaget's theory of intellectual development… or Skinner's behaviorist theory of learning" (p. 80), which they characterized as "immature," "imprecise," or "too high-level" (p. 80), they provide a means by which to categorized different levels of theorizing that occur during or result from DBR, where theory and theorizing guide decision making on multiple levels. This multiplicity is useful for connecting this current work to both larger theoretical constructs and less grand but higher utility theory that can impact pedagogical choices.

Orienting Framework

Orienting Frameworks (e.g., poststructural or sociocultural theory) inform instructional design and are useful because they provide shared vocabulary and background knowledge for researchers. They are, however, limited because much of what goes into design research is beyond the explanatory power of the frameworks. Rather than providing constraints or prescriptions for action or design, orienting frameworks inform general parameters influencing how to think about "learning, teaching, and instructional design" and can be embraced as "meta-theories" (diSessa & Cobb, 2004, p.

81). In this work, as spelled out in Chapter 2, my orientating framework is Activity Theory (Engeström, 1987), particularly the top pinnacle of the Activity System model that represents mediating tools, the artifacts of the Activity System. In this case, the system is the basic computer skills workshop and the tools are the instructional strategies and website employed, which mediate the work of the TAC members (the subjects) as they work to support learner (object) engagement (outcome).

Framework for Action

"Frameworks for Action" are less-grand theories; rather, they are pedagogical strategies. diSessa and Cobb pointed to Reciprocal Teaching in Brown's (1992) study as an example. Frameworks for Action provide concrete focus that shapes design and serves as a heuristic for determining impact. They are significant because they help us manage a gap between theory and design. In this study, the Framework for Action was the Silver Pacuilla and Reder (2008) model representing the skills threshold required for learning online. In this case, as indicated in the needs analysis described in Chapter 3, an intervention resource needed to support the attainment of an equitable distribution amongst three components: learner skill, support available, and the difficulty of task at hand. The design of the study, then, worked toward that end. It simultaneously strived to solve a local problem while it contributing more generally to theory as it addressed these defining questions:

1. What characteristics of the intervention, made visible during the design process, are identified by TAC members as supporting their instruction?

2. What learner needs become most salient to novice teachers working in predominantly English language settings as they design and implement strategies and resources for digital literacy instruction for diverse student audiences?

Methodology

I crafted my DBR approach for this study based on the work of Sandoval and Bell (2004), learning scientists concerned with cultural and situated aspects of learning, who put forth a 'big-tent' vision for DBR that draws on a pluralistic view for the origins and goals of DBR. They argued against narrow interpretations of DBR as a methodology and urged researchers to bridge theoretical and methodological boundaries, choosing research methods determined by the requirements of the problem at hand and the intended design. This school of DBR is theory-driven, empirical research of instruction that is based on a specific intervention. Guided by the theoretical orientations and with the goal of accounting for an argumentative grammar to justify or provide structure to design, my DBR research relied on a combination of McKinney and Reeves' (2012) Educational Design Research and conjecture mapping described by Sandoval (2014). I will explain how they have worked together in the section that follows.

Conjecture Mapping for Argumentative Grammar

Sandoval (2014) defined conjecture mapping as follows:

> I propose conjecture mapping as a method for articulating the joint design and theoretical ideas embodied in a learning environment in a way that supports choices about the means for testing them. Thus,

> conjecture maps clarify how a research team views the concurrent effort of practical improvement and theoretical refinement in terms that include at least some elements of an argumentative grammar (p. 20).

In order to simultaneously build an intervention and build knowledge on how to best support ELLs in such a learning environment, I paid careful attention to laying out and documenting the intervention design process. Sandoval's (2014) conjecture mapping model served as the tool for this work. Mapping of conjectures makes evident how ideas are reflected in design and how they promote learning or some other intended outcome. They do so by linking design and theoretical ideas, articulating aspects of the design and how they are mediated to produce intended outcomes. Sandoval mapped out these relationships in the conjecture map model pictured in

Figure 4.2.

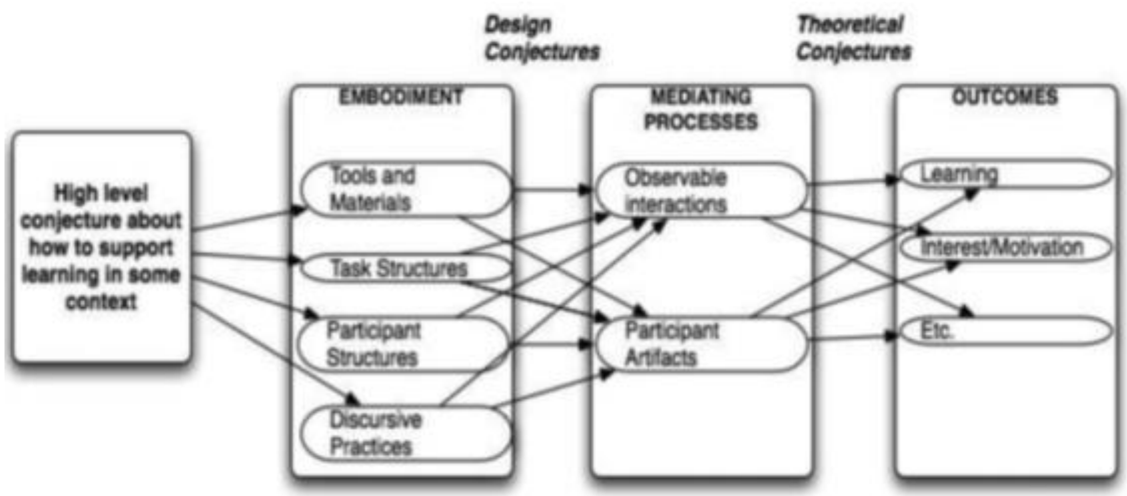


Figure 4.2 Sandoval's conjecture map model (Sandoval, 2014, p. 20)

The multiple arrows in the model indicate that each component operates uniquely on the other components and that not all components in each category are evident in every study. The high-level conjecture (on the far left) and the intended outcomes (on the far right of the model) are linked by the process of developing a resource, which serves as the embodiment of the ideas articulated in the conjecture. According to Sandoval, these can be tools and materials, task structures (e.g., classroom activities), participant structures (e.g., the way people interact) and discursive practices (e.g., the way communicate). An embodiment triggers mediating processes that make the outcomes possible. These mediating processes are made visible in interactions and artifacts.

The description of how this all happens is captured in a design conjecture, which frames the connection between the embodiment and the mediating processes, generally through an "if" "then" statement like, "if learners engage in this activity (task + participant) structure with these tools, through this discursive practice, then this mediating process will emerge" (p. 24). This conjecture spells out why an embodiment is designed the way it is. Finally, a theoretical conjecture makes the final connection to outcomes by linking them to mediating processes. These are the ideas about how the two are connected, "if this mediating process occurs it will lead to this outcome" (p. 24). This is the new theory that is generated through the design process.

Educational Design Research for Structure and Process

I used conjecture mapping to provide a structure for connecting design to theory, but needed to draw on the approach of McKenney and Reeves (2012) to provide guidance on how to conduct the process of building the intervention. McKenney and Reeves (2012) wrote that the development of a supportive resource should be "systematic and intentional, but the attention during the development the resource also include inventive creativity, application of emerging insights, and openness to serendipity" (p. 109). Ideas start out broadly defined, but are then refined as considerations of environment and theoretical knowledge are integrated into the design process. This leads to potentially useful options that are, in turn, developed into a "skeleton design" and then a testable prototype, which is an initial and likely incomplete iteration of the resource. I employed this process with the aim of doing research *through* design, rather than research on design, so though a tangible product of the study is an intervention resource designed to support instruction, "inquiry focused on understanding the responses the intervention engenders" (McKenney & Reeves, 2012, p. 23). An important goal of the study was to better understand the impact of the development process on the AmeriCorps member participants and their instruction.

EDR and Conjecture Mapping Together

Together, the two approaches described above, Conjecture Mapping and EDR, afforded the means by which I could organize my research process and develop the argumentative grammar needed for connecting resulting design to theory. I show this relationship between the two ways of engaging in DBR research through Figure 4.3.

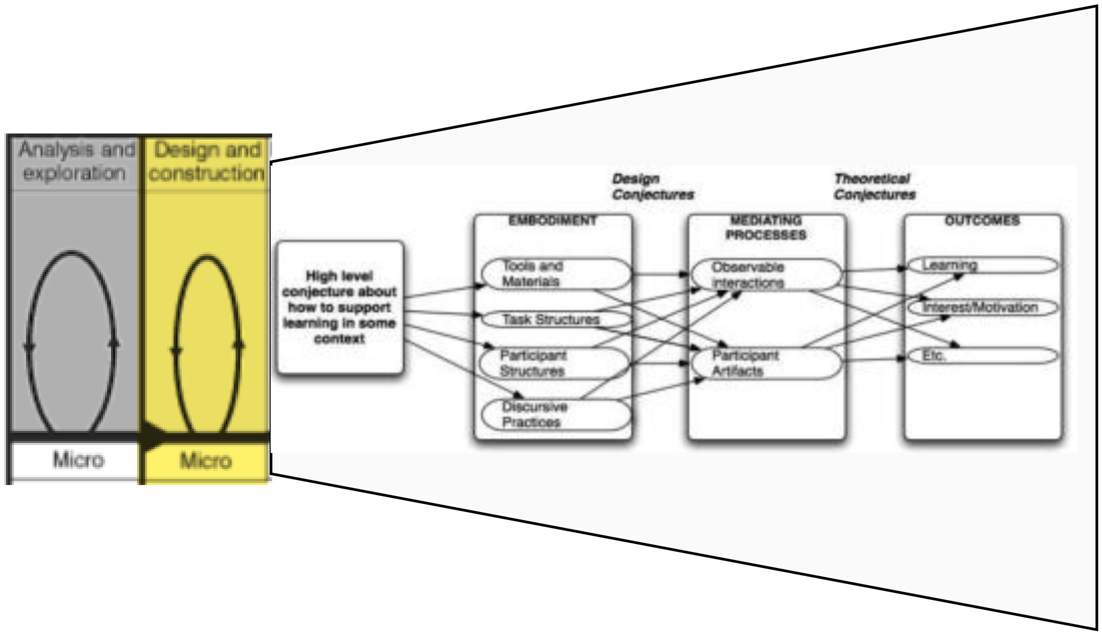


Figure 4.3 Linking EDR micro-cycle to conjecture mapping (from Sandoval, 2014, p. 20 and McKenney & Reeves, 2012)

Methods

The data sources used here were the same as in the other studies: classroom observation, focus groups, interviews, field notes (both my own and those of the TAC members), and classroom artifacts (see pp. 51 - 43 in Chapter 2). The period of time included in this process begins at the beginning of May 2016 and stretched through December of 2016, the design and construction phase, with the bulk of the website development occurring between June and August, 2016.

Site and Participants

The focal participants and the sites described in the previous chapters are the same here. In DBR, the success and utility of any intervention is based on collaborative design with stakeholders in a specific context. Because these focal participants represent the range of agencies served by the umbrella AmeriCorps program, the local solution developed to support their instructional challenge represents both distance near and distance far relevance. That is, the local solution was useful at the participation TAC sites and also, likely has relevance in the 30-plus CBOs who operate under the same AmeriCorps program. The research thus serves the dual purpose of addressing specific instructional challenges while also adding to disciplinary knowledge in the areas of digital literacy instruction, online learning, and identity and language learning.

The Design Process

The intervention resource was designed to mitigate lack of training and expertise of TACs and to ensure that learning resources were accessible and the presentation of the resources was structured to support access to the broadest audience possible. In other words, the website was designed to make use of research-based recommendations regarding usability in the following areas: clear layout, intuitiveness of affordances, limited but direct and descriptive language, and culturally accessible resources. The process of designing this website is the crux of the work reported on in this chapter, and before answering the research questions and beginning to map out the theoretical implications of the work, I need to spell out the design process.

Design and Construction Micro-cycle

The initial design of the resources was grounded in literature on academic English and content-based instruction (Arias & Faltis 2013; Schleppegrill, 2004), usability issues in online environments (Gaver, 1991; Kirschner et al., 2004), and content and pedagogical considerations regarding materials selection (Mishra & Koehler, 2006; Tomlinson, 2012). It was also grounded in the identified needs of the TAC members, who were impacted by the instructional challenge and collaborated in design of the resource.

The high-level conjecture is where the work started; it was drawn from what was learned in the needs analysis. *To mitigate the lack of training and experience (and ensure an equitable distribution amongst learner skill, task required and support available) TAC members need to make use of a digital homeroom (DiHo) as resource that scaffolds their instruction.* This idea presupposes that the relative inexperience of facilitators could be mitigated through the use of a centralized space, a website from which learners connect with learning resources, the provision of which could lower the technology demands and scaffold the instruction provided by the facilitator. It is through analysis of the design of this resource that I learned about how to best scaffold instruction of untrained teachers working in such environments. I will trace the design and construction process as laid out by McKenney and Reeves (2012) that is represented in figure 4.4 below.

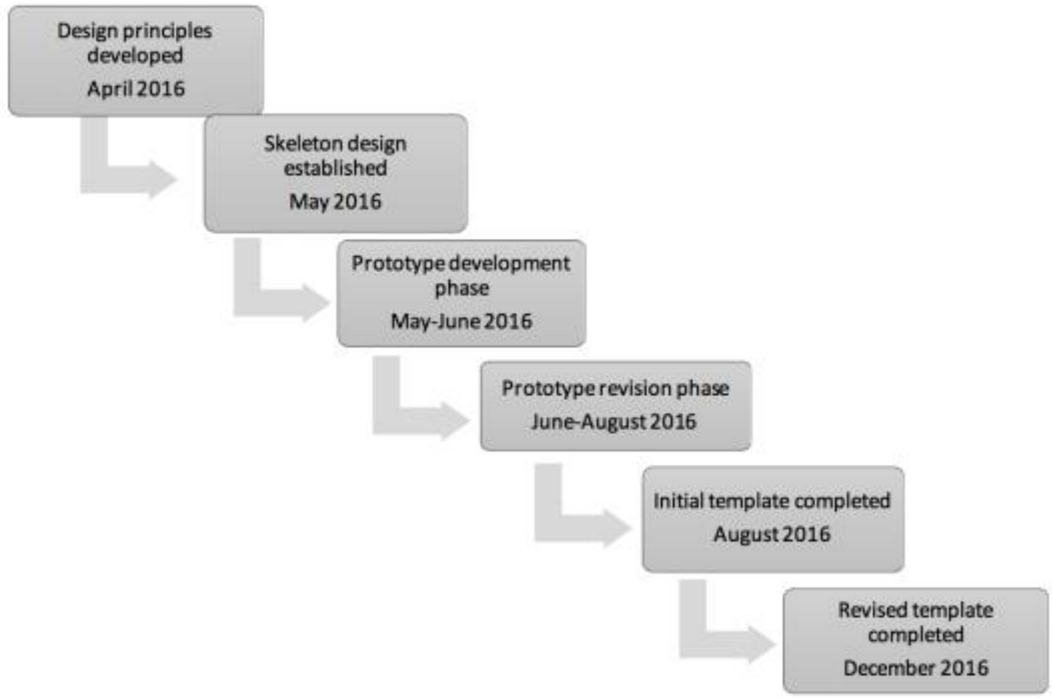


Figure 4.4 Design and construction process and timeline

Design. The EDR process requires laying out the design requirements of the intervention by first articulating design principles. The design principles for this work are listed below in Table 4.1 and represent the findings of the needs analysis, the study described in Chapter 3.

Table 4.1

Design principles identified in the needs analysis

Design Principle	**Description**	**Codes Identifying Characteristics & Elements**
DP 1: Purpose	The designed resource is a website that can support	*Support for teachers; Extend learning out of classroom; One website;*

	differentiation in classroom learning and be used by students outside of class for additional instruction and practice	*Differentiation; Mobile compatible; Self-access; Use tech to teach tech; Short activities easily accessed;*
DP 2: Vocabulary	The website must include support for development of key vocabulary	*Vocabulary needed; Repetition*
DP 3: Useful across settings	The website needs to provide support for novice or untrained teachers in the multiple sites, diverse participant settings	*Customizable; Ease of maintenance; Diverse audience; Flexibility of use; Resource evaluation; Structure; Template; Adaptable; Need for Northstar Digital Literacy Assessment preparation*
DP 4: Learner Needs	The website should be inviting and relevant, attending to learner affect and skill level.	*Accessibility; Affective support; Resource as recruitment tool; Multilingual; Simplicity; Autonomy; Connect people; Relevance; Specifically, for learners; Internet access; Structure scaffolds skill*

	development; Nascent computer skills; Learner Corner; Log-in debate

The table shows the codes that elucidated the design needs articulated by participants as four discrete design principles, which guided the development of the website. It was clear from the data that core members needed the website for two reasons: to differentiate instruction in the classroom and for extended learning opportunities beyond that time and space.

This is reflected in DP1: Purpose. The needs analysis also indicated a need for support teaching vocabulary of computer skills in tandem with actual skill instruction (DP 2: Vocabulary). Next, DP 3 characterizes the expressed needs regarding utility of the website across contexts and need for customizability that would support future corps members make minor changes to better align the tool with their learners' needs. The website and the website design tool (i.e., website construction products like Weebly, Google Sites, etc.) needed to be easy to learn to use, easily updated, free, and provide flexible page management and support or a user manual. The product needed to feature drag-n-drop content and easy image resizing. These tools all needed to be accessible through a wysiwyg (what-you-see-is-what-you-get) editor and require only very limited html or CSS coding, if any at all. Finally, as captured in DP4, the design of the site needed to reflect what was known about learner needs. For example, it needed to allow for different modes of learning: video, text, audio; use of icons rather than text; clear navigation cues; and be free of advertising.

These design principles were reflected in a guidance document that the participants presented to the larger AmeriCorps group in August of 2016. An excerpt of the slides shown is shared as Figure 4.5.

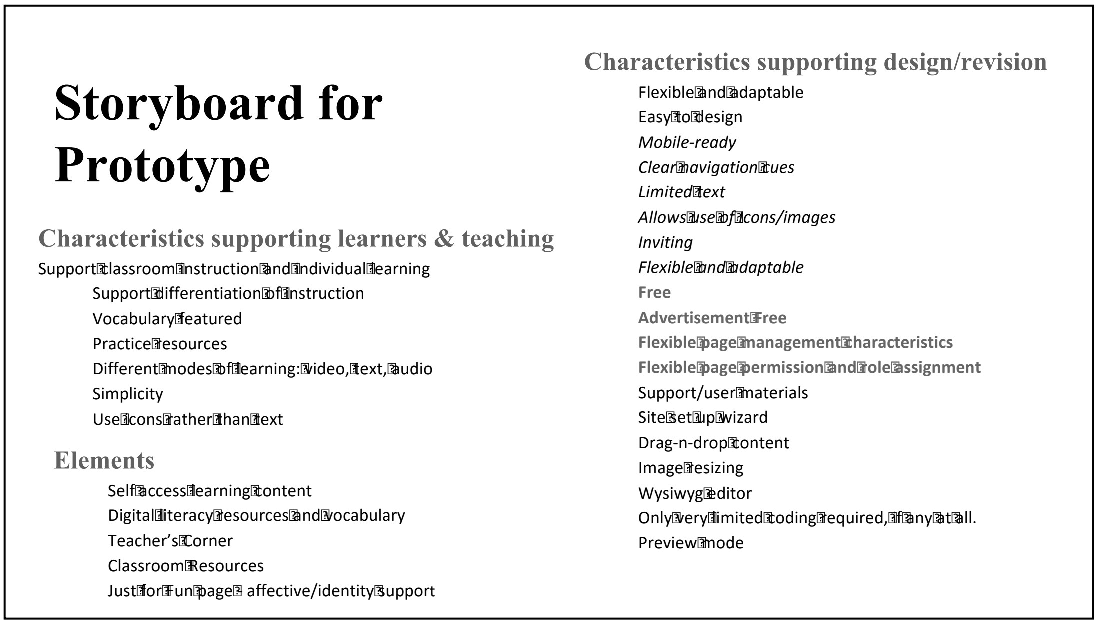


Figure 4.5 Slides reporting on requirement of the design

McKinney and Reeves (2012) suggested the next step in development of an instructional resources is to build a skeleton design that includes the design principles. So, based on the characteristics listed above, the participants and I created a skeleton design developed in Google slides and pictured in the figures below.

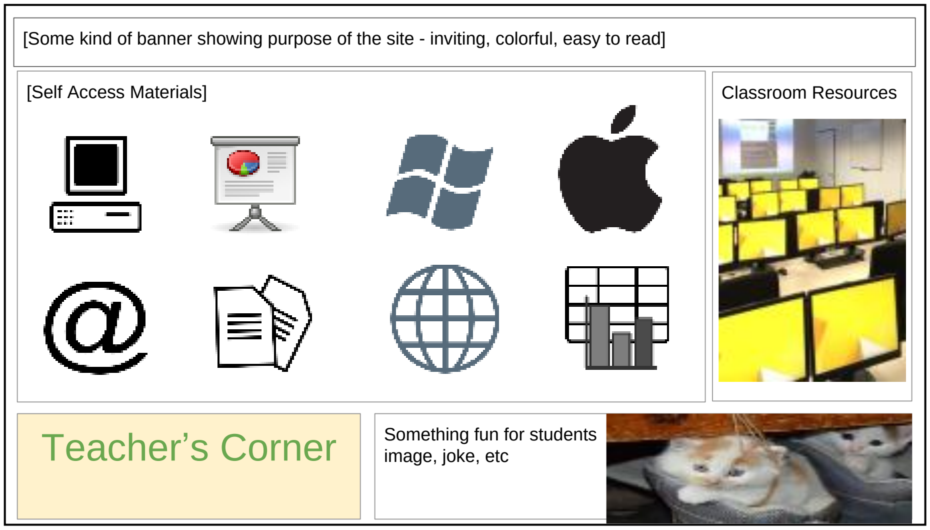


Figure 4.6. Skeleton design home page

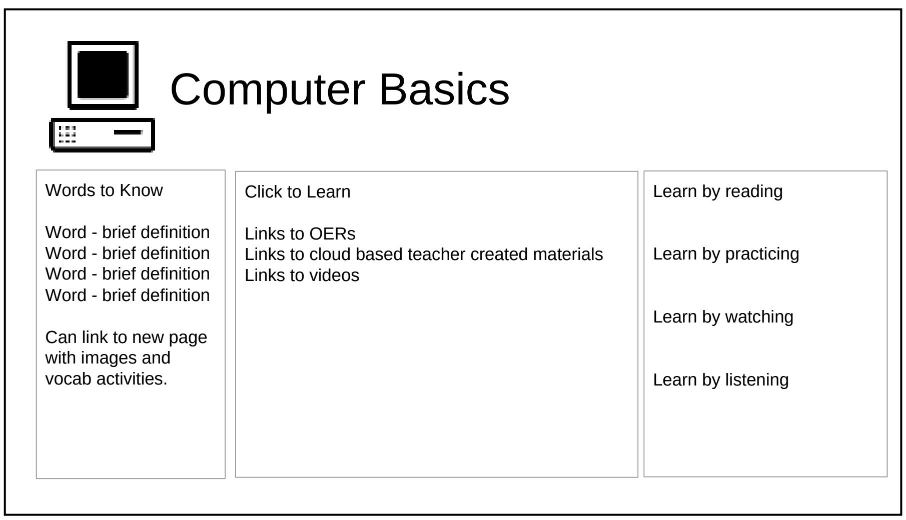


Figure 4.7. Skeleton design sample skill page

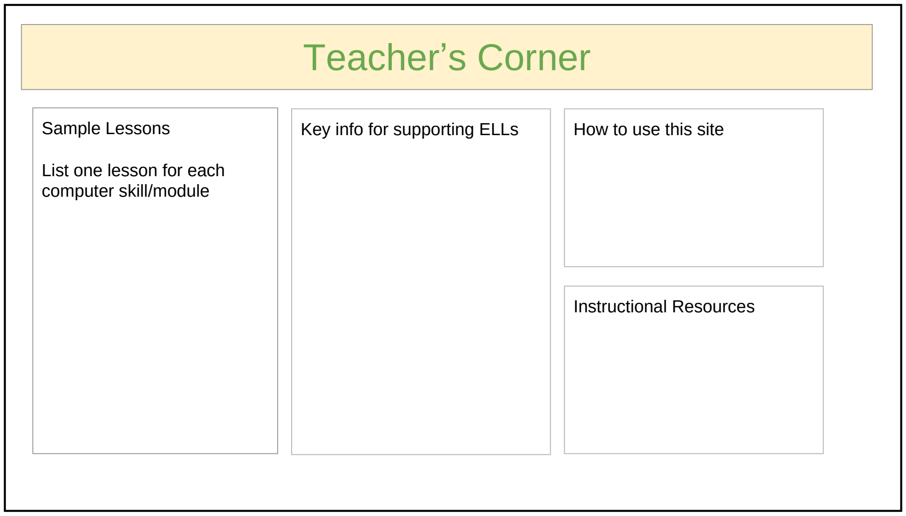


Figure 4.8. Skeleton design sample teacher’s corner page

Construction. The participants took this skeleton and started construction of their prototypes. This phase was a two-step process: 1) each member created his or her own design and continuously refined or reconfigured according to use, and, after two months of prototyping; and 2) the group convened to create a template that served as the final version of the product. The individual websites that each TAC member constructed are what McKinney and Reeves (2012) call prototypes. Each prototype incorporated the design principles and was based on the skeleton design and specifications, but inevitably many decisions about design occurred during the process of construction and trial use. Prototypes, are therefore, drafts in various stages of completion. As the intervention resource matures, the prototypes grow in sophistication and utility, where eventually every component piece is fully developed and operationalized, rather than serving as placeholder (McKinney and Reeves, 2012). It is this process of development from largely nonfunctional skeleton to fully developed prototype where the questions to the research questions were answered.

Analysis

McKenney and Reeves (2012) suggest that the ‘design and construction’ micro-cycle of EDR does not, on its own, “involve empirical data collection” (p. 109), rather, it is a description of the development process. This proved true in the ‘design and construction phase described here; however, I did employ general qualitative analysis needed to broadly capture and describe events of the development process as I read through these data. For this purpose, I revisited the data structurally coded (per Saldaña, 2013) as *Design process* and the sub codes included therein: *Learner preference, Design limed by knowledge of site, Skills delimit design, Aesthetic preferences, Initial conjectures, abandoned ideas,* and *First designs* (for descriptions of these codes see the codebook in Appendix E). When the flow of analysis required alignment with the aspects of design most salient to learner needs and classroom management, I also referred back to the coded data described in the previous chapters. Note that in all cases, my reading of the data was initiated to see how the design process and resulting website stayed true to priorities articulated in the needs analysis and, where possible, elucidated, refined or revised design ideas based on use.

Findings

The findings of this study are framed in response to each research question that drove this part of the inquiry. The focus group discussions, classroom observations, field notes and website prototypes generated data that elucidated the process of developing the instructional resource, including shifts in design that occurred during the process.

Characteristics that Supported Instruction

The first research question*, what characteristics of the intervention, made visible during the design process, are identified by TAC members as supporting their instruction?* is answerable by seeing how the TAC members responded to the design principles and skeleton design to craft their own prototypes. The most salient observations represented by the examples below deal with both the structure of the websites they created and the resources linked to from them.

Ample resources. The first finding is that through the development process, the TAC members learned that in order to be useful for differentiated instruction, the website needed to link to ample resources that afforded opportunities for choice. There needed to be something there for most any learner who would come into the lab. Initially, the participants had felt that a long list of available resources was counter-productive; their prior experience using the materials left by previous TAC members was that learners generally relied on the first few at the top of the list, whether or not they were suitable. For example, in the focus group on May 20, 2016, Marty said,

> *We tried that on a wiki site and students only pick the first website. And so, because of that, I think it would be interesting to look into [having access to more than one resource] but I also think it would also, it would just be practicing the same thing that we've done. More students will just pick the first item on the list or do a lot of scrolling up and down and get the last on the web page."*

Marty’s suggestion was represented in the initial prototypes of the corps members, which linked to one featured resource for each skill covered in the website. As evident from the transcript excerpt from the focus group, Marty stuck to this format and created opportunities by making frequent changes as her class moved through different skills.

Jen Okay [0:28:00]. So, I'm noticing something here. A similarity is that you guys have structured the site to allow for one primary resource only for each skill. Was that intentional or is it like you want to do more…? So with both of you I have the same question. So what will you do when you want to expand to other skills?

Marty I would delete the button or I would add a new button or delete the skill and add a new skill.

The site Marty described in the excerpt above is featured in Figure 4.9 below.

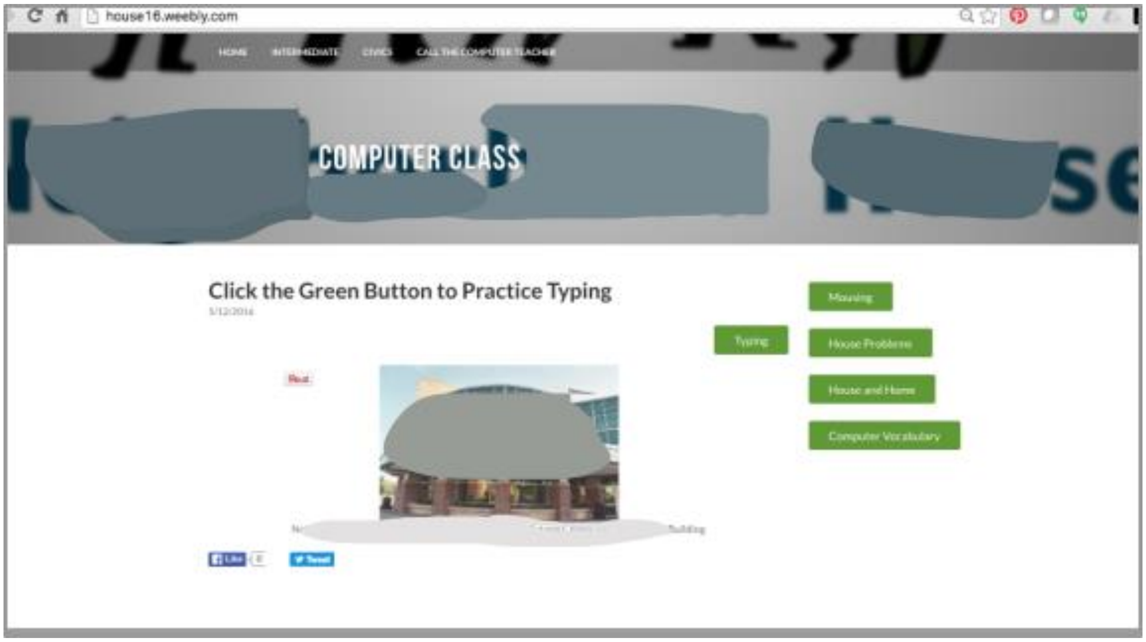
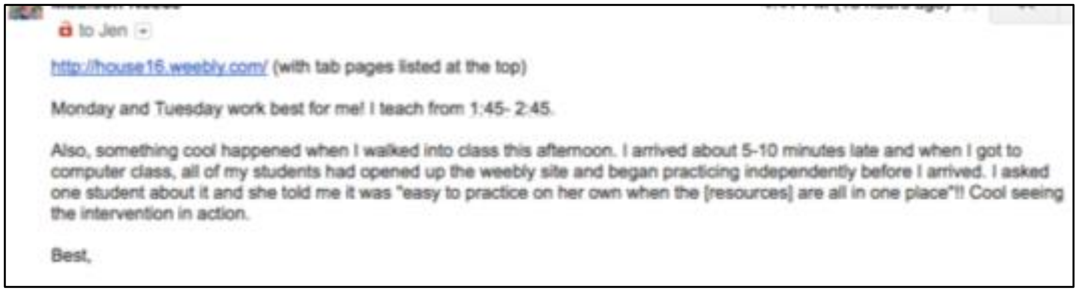


Figure 4.9. Marty’s first prototype, a Weebly site

In this image, you can see text links (in green text boxes) that sent learners to different topical lessons. The top link is for a Mousing tutorial. The one below it and to the left linked to a Typing tutorial. Marty would change these links and the text labels depending on the focus of her computer skills instruction on any given day, essentially determining for her learners what skills they need to cover and providing only one opportunity for them to do so. Note that she relied on text links, not the icons that were suggested as priorities by the design principles.

She found that the site was useful as a flexible way to start her class, rather than a tool for differentiation used during the class. In an email sent to me in mid-May, Marty wrote that her learners were beginning to use the site without her directions to do so (See Figure 4.10).



to Jen

http://house16.weebly.com/ (with tab pages listed at the top)

Monday and Tuesday work best for me! I teach from 1:45- 2:45.

Also, something cool happened when I walked into class this afternoon. I arrived about 5-10 minutes late and when I got to computer class, all of my students had opened up the weebly site and began practicing independently before I arrived. I asked one student about it and she told me it was "easy to practice on her own when the [resources] are all in one place"!! Cool seeing the intervention in action.

Best,

Figure 4.10. Email from Marty

However, over time, it became clear that one resource was inadequate. The strategy was actually making more work because the links had to change frequently and it was not possible to use it to support differentiation; she needed choices for learners and a pathway to more complex skill development. Additionally, because this Marty's site and the other TAC members' initial prototypes also linked to the Northstar Digital Literacy Assessment, they noticed that learners would frequently use the assessment for practice after they had completed the one resource provided or if the lesson of the day was not relevant to them.

Classroom observation data suggests that the flat structure and text links she provided (rather than icons linked to resources) limited the functionality of the site. Indeed, it was a shift in the works from the very beginning of the design phase. In the May 20, 2016 focus group, Marty was asked about how her prototype aligned with the skeleton design. She responded that it was a challenge for her to do follow the skeleton in the website builder that she had chosen, Weebly.

Marty I tried to get something like that going on my Weebly page. And I didn’t have the flexibility or the space. And so, I found myself sacrificing items. So, I went with the, something for students which is going to be in my like my master distribution, classroom resources and then self-access materials. So I have to like get rid of the teacher’s corner and like the North Star stuff and the icons. And so I'm starting to think like, “Okay I wonder if maybe Weebly is a little bit too simplistic.”

Layered structure. This need for more resources pushed an important shift in the design of the website, a shift from a flat to more layered structure. This is seen in the data drawn from a focus group on June 24, 2016. First Marty, explained why she had abandoned her Weebly site; it was limiting, not allowing adequate space for linking to resources she wanted her learners to use. *“Okay, yeah I ditched my Weebly like three weeks ago because I hated it, not hated that’s a strong term. I didn’t think it was very functional”* (Marty, 6.24.2016 focus group). This issue was reiterated as important by others in the except that follows.

John [After having described his site] so that’s basically the things that I have got up there and what I want to do is, I’m going to break this down using those icons like you have computer, I’m going to have mouse skills, typing skills and then I’m, and then computer vocabulary and then

Jen	So, you decided you can't have this flat structure, you need to have layers?
John	Yeah.
Jen	That's what you learned?
John	That's it's got to be simple like and then I'm going in to email and then I'm going to have the vocabulary, formal email, now you know that kind of thing, and the parts of the email address
Jen	And, Marty, I think that was something you found too, right?
Marty	Yeah.
Erik	I really like it!

After this meeting, Marty and Erik each spent time revising their websites to create a layered structure that allowed for more resources. The Google Site that Marty designed is shown in Figure 4.11.

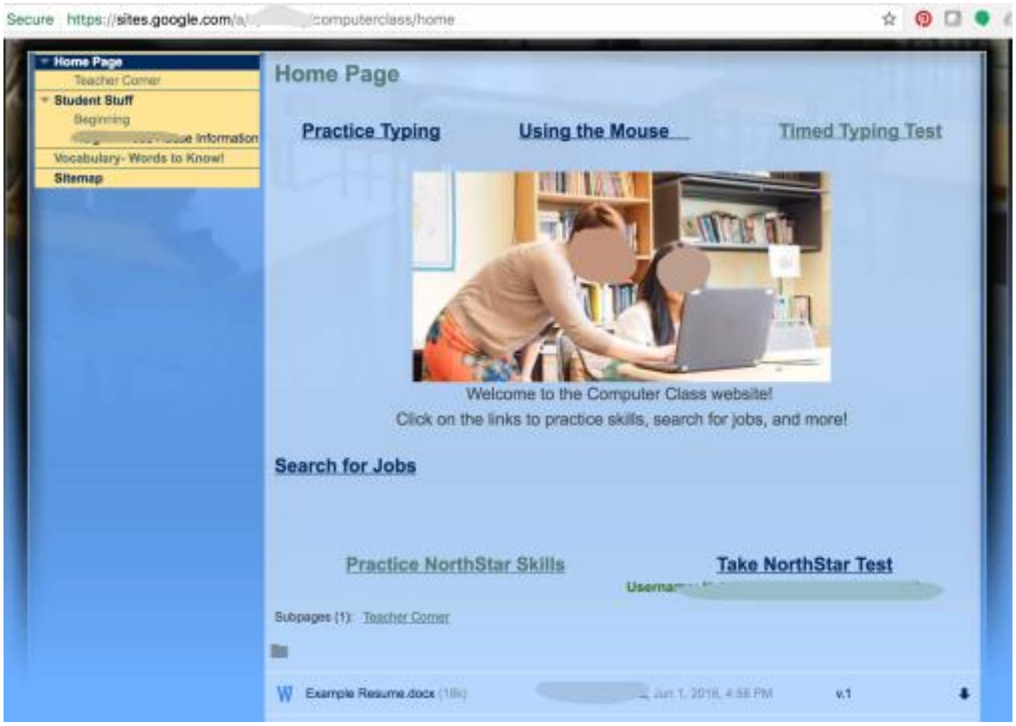


Figure 4.11. Marty's second prototype, a Google Site

Though this was not a fully functional prototype, it is evident from the navigation menu on the left that Marty had set up subpages that she could have used to present a layered approach to her resources, adding "Intermediate" and "Advanced" to the list beneath "Beginning".

This growth is more clearly illustrated by changes Erik made to his prototype. In Figure 4.12, the screenshot shows his first prototype that linked learners to one resource per icon.

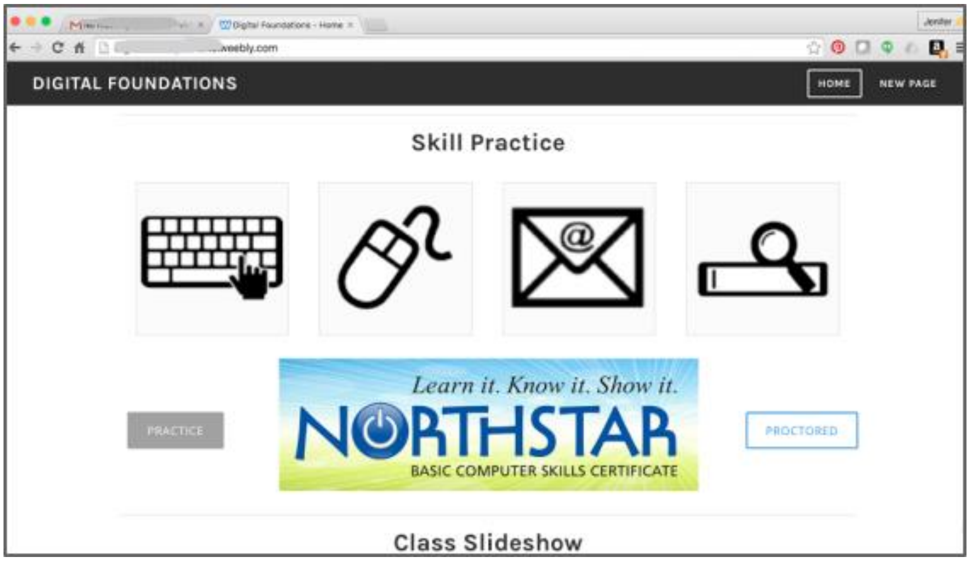


Figure 4.12. Erik's first prototype, a Weebly site

One month later, after the conversation featured in the transcript above, Erik revised his design to include a more layered approach and more resources.

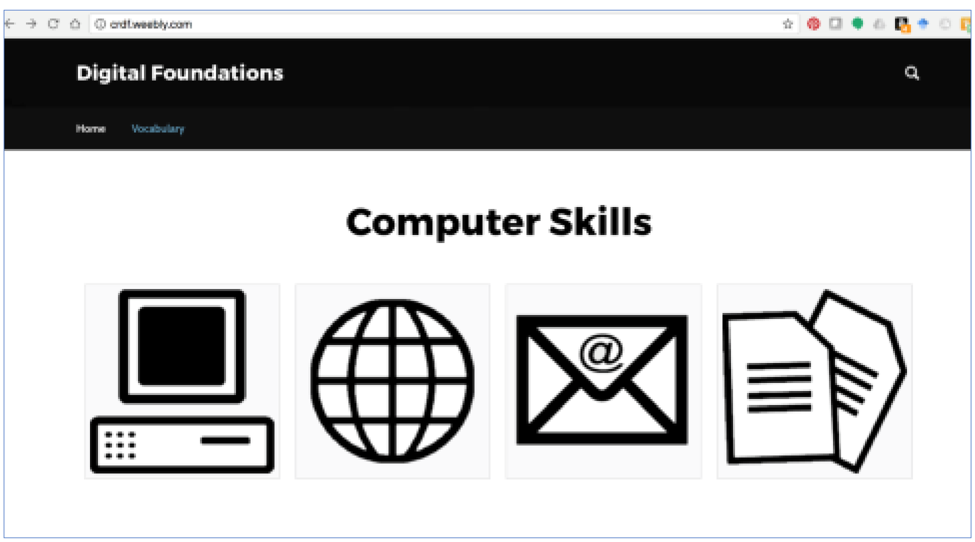


Figure 4.13. Erik's second prototype, a Weebly site

The icons he integrated in his homepage were intended to link to different levels on four different subpages, as shown in Figure 4.14.

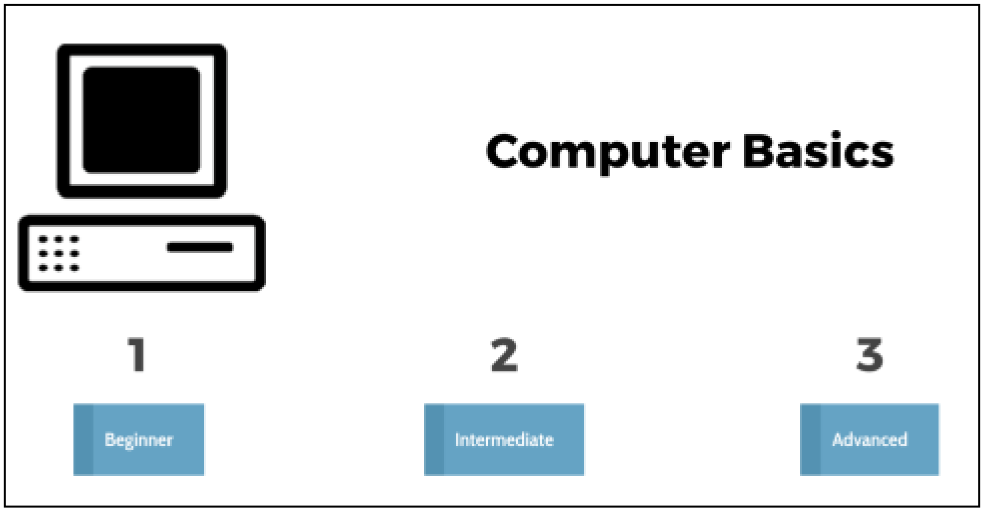


Figure 4.14. Computer basics subpage

Erik So, you click here for computer basics and then you breaking into beginner intermediate and advanced…So back to, with your computer basics and then let’s go beginner. So, this is the part that I'm still working on. One is a tutorial one is an activity. So, you go tutorial activity within beginner, tutorial activity [implied ‘within intermediate’] and then, so the only one I have built out right now is mousing. It’s going to be the same across [all skill areas].

Erik also removed the link to the assessment in order to avoid having learners click on it for practice. Erik described his shift in the June 24, 2016 focus group.

Field notes from his class a few days later reiterate the impact of the changes he made.

> *…looking at how students reacted to the organization of the website I’ve noticed that a lot of students like progression, being able to move from one thing to the next so the beginning, intermediate, and advanced levels makes a lot of sense. I think we’ll do it that way and maybe even apply numbers to help people able to get through things and make it feel like they are progressing through the class*

(Erik’s field notes dated June, 26, 2016).

The following week, Erik observed that not only did the students make use of the progression, but the use of images instead of text links was helpful; *“Jump-In Icons help ease the transition to new activities”* (Erik’s field notes dated June, 28, 2016). This highly pictorial, layered approach became the favored design and eventual structure of the final website, pictured in Figure 4.15, which the TAC members began to call the digital homeroom, or “DiHo”.

Figure 4.15. Final DiHo template

In the final design and template the pages that provided differentiation were stacked below each skill category icon, first by level as seen in Figure 4.16 and then by learning modality, as seen in Figure 4.17.

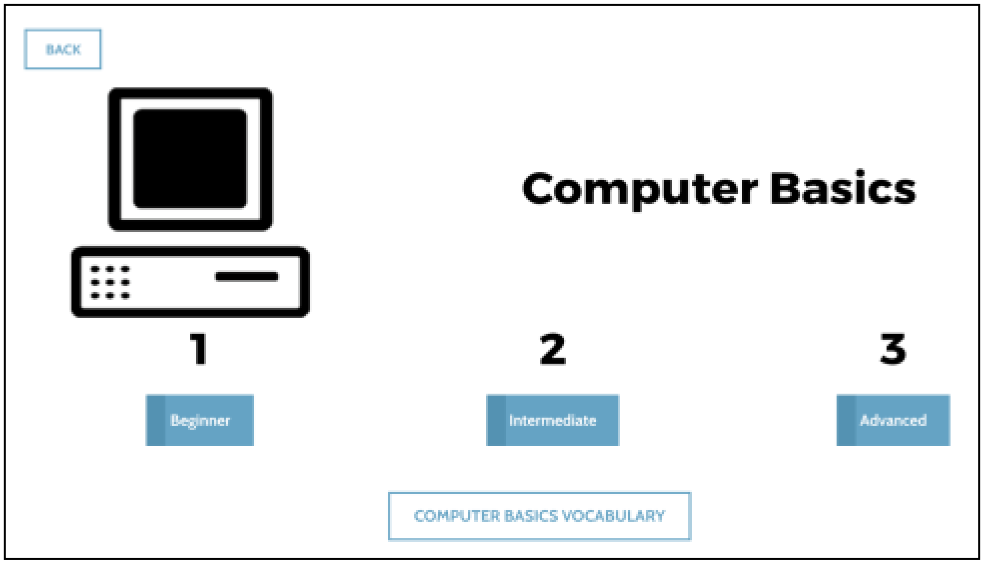


Figure 4.16. DiHo level options

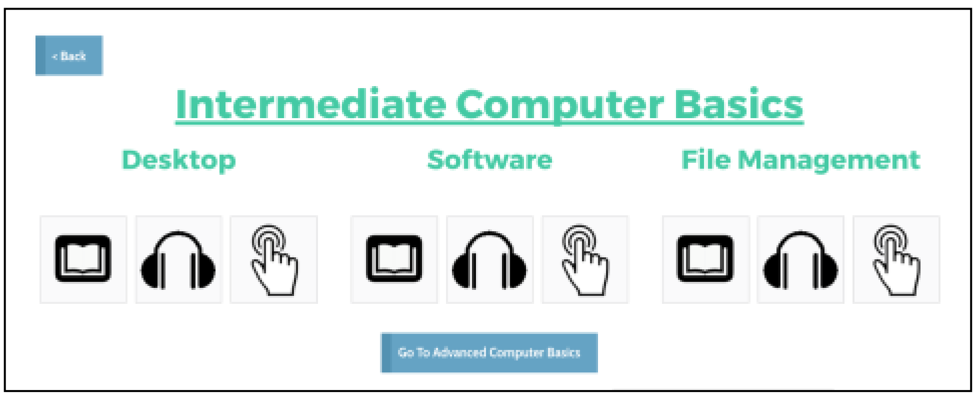


Figure 4.17. Different learning modalities

The decision to provide multiple modalities grew out of TAC member observation about the wide range of literacy proficiency represented in their workshops and labs. Though they needed to have video or audio options and interactive options, they also wanted to have options to learn by reading when bandwidth was limited or when speakers or headphones were not available. The use of color in the text shown on Figure 4.17 is also significant. In order to help with navigation, the TAC members agreed to consistently use three different colors to represent the three levels (beginner, intermediate and advanced), where Advanced, for example, was always shown in green.

Impact of well-structured website. This carefully laid out structure, the supportive use of icons and color, and the time put into developing the website created trust in its utility. Because of this trust, I argue that the TAC members turned over control previously manifested in teacher-centered, large group instruction. In his notes, from mid-May, Eric said that even his first prototype did this: *"People appreciated having the website and it made my job alot easier because I was able to focus on students individually but not have to run around and check what each person was doing."* Later, on June 26, 2016 Erik wrote that the website *"helps with classroom management because nothing is centralized [that is, emanating from him as the center], and so I can spend alot more time having volunteers work through the web interface with students and it is very effective and I think and I think it helps volunteers feel more comfortable in their role because they have a guide as well."* Two days later in a field note on June 28, 2016 he wrote the site supported *"individualized interactions."* My own field notes from classroom observation support his conclusions about how the use of the website supported his instruction, showing more time learner time spent working independently and less teacher-centered instruction throughout the construction phase.

Marty also noted the impact of choice. In her field notes from February 2017, reporting on her use of the final version of website she wrote, *"Beginning learners really liked being able to choose what kind of activities (by learning style) they got to work on.*

The flexibility allows for a lot of exploration of the site and I know two students especially appreciated this." Marty also noted throughout the design and construction phase that learners had been able to use the site out of class, which satisfied her goal of extending learning opportunities for learner who could not come to class.

Identifying Salient Learner Needs

The most exciting findings of the study dealt with how, over the course of the research, the TAC members began to notice their learners' reactions to their instruction and the designed website. These findings address research question two: *What learner needs become most salient to novice teachers working in predominantly English language settings as they design and implement strategies and resources for digital literacy instruction for diverse student audiences?*

My analysis elucidated three main findings in answer to this question: 1) vocabulary instruction built into the website needed to align with computer skills included there; 2) the site needed to be accessible; and 3) the selection of the resources stocked in the site should have been supported through an evaluation process, though it was not a priority of TAC members to use an evaluation rubric.

Vocabulary and skills integration. The role of vocabulary in the TAC members' instruction is more closely examined in Chapter 5; however, there is one point that is relevant to this analysis, how a glossary evolved over the course of the construction cycle. The inclusion of a glossary, or "vocabulary page" was agreed upon by all participants from the beginning of the design and build phase and was mentioned in as a need in the analysis and exploration phase. In his field notes from mid-June, Erik observed,

> *I also saw how people reacted to the beginning vocabulary* [page] *which I think went really well. Because it gives people sort of a needs assessment, allows them to assess themselves on where they're at and words they know and then the can fill in the blanks and then we can review it as an entire class. So, I will continue to build out the website as it continues and do my best to make it user friendly.*

Later in the month, he shared his website and the vocabulary page with the other TAC member participants.

Erik So, we'll start with, and then you can go to your vocabulary page. So, we'll just do that quick. People can practice by scrolling over and then it tells you the word for them.

Jen Right.

Erik Right now, I'd not have meanings or like what they do. I don't know yet if that's going to come out. And then I have the list built out for this but I haven't put them in there.

Marty This looks so clean and nice.

Jen Right!

Erik Yes, so the nice thing is that they can just cover over them. So, we use this once and it was so much easier than me going through them the first time. It's good for review and things like that.

(June 24, 2016 focus group)

Erik's work grew into the first iteration the glossary of words that the corps members felt they could use to help their students learn computer skills. Erik and Marty continued to rely on the glossary in their second program year when they began using it with their learners in September 2016. It was at this point that a new participant joined the project, Samantha from Digital Youth. Erik and Marty invited Samantha to join the project because she had strong video editing skill that they felt would be helpful for creating teacher resources to help others customize and use the site.

During one meeting in late 2016, Samantha noticed that the organization of the glossary was not aligned with the way the skills were laid out according to skill level or type. For example, hard drive, disk drive, and memory had originally been placed in the advanced computer basics vocabulary. These placements had been made based on how often the TAC members felt their learners were likely to use a word; however, the skills associated with these words were included within the beginning skills page in the "hardware" section. Similar misalignment was found throughout the website. At a focus group meeting in January 2017, Samantha, Marty, and Erik decided to rearrange the vocabulary and add words that were important for successful use of the learning resources but had not been included in the glossary. In the updated version of the glossary there was a comprehensive set of vocabulary words at three levels (beginning, intermediate, and advanced) that aligned with the linked resources found on the beginning, intermediate, and advanced pages in each skill area.

In her February 26, 2017 notes on use of the final website, Marty wrote that her beginning learners, *"really responded to the clear images (in Beginning and Email) … Students at this level spent much more time using the vocabulary sections…"* She also noted that her five advanced students in class that day *"really liked being able to open up MS Word/ Email and compare the vocabulary to the Digital Homeroom vocab screens. I noticed my students opening and minimizing screens to test themselves on their vocabulary. This was really cool."*

Access. Observed use of the DiHo during the construction phase and beyond suggested that the design principles laid out in the design phase adequately supported the development of a website that was useful for a wide range of learners. In Erik's field notes from June 15, 2016, he observed that the jump-in icons (i.e., the images used instead of text hyperlinks) were *"intuitive"* and supported learners "*ability to navigate the website with limited guidance*". It seemed the biggest barrier was getting the learners to the website the first time they logged in from their classroom computers.

Both Marty and Erik noted the importance of simple URLs. In Marty's field notes from May 13, 2016 she wrote that it had taken almost two minutes to help a student log into her Weebly site "house16.weebly.com" and that it had taken six minutes to get all of the students logged in. The problem was worse with the Google site that she tested in June. In the transcript from the June 24, 2016 focus group she said, *"The hardest thing I've run into with google sites is the URL's kind of a mess … It's like sites.google.com/a/blah blah students".* Compounding this problem was a cached Google site URL on the computers in her lab. As students tried to get to her prototype, the browser address bar auto filled the old URL, which was very confusing for her students. She abandoned her second prototype in Google because of this difficulty and the length of the Google site URL.

Erik, too, found URLs to be a challenge. He experimented changing the URL to his Weebly, noting on June 26, 2016, *“another thing is the URL of our webpage. Originally it was four letters “crdf” and I changed it to “digitalfoundation” and that I think confused students more. There will likely need to be a way to get students to the website easier than just typing in the URL because it often times creates frustration just trying to get to the learning tool.”* He ended up leaving his prototype URL “crdf.weebly.com” because it was shorter.

Resources. The final need that became salient to the TAC members concerned the external resources that they linked to from the DiHo. In addition to attending to the number and organization of these resources, as described above, they also grew to better recognize the quality and relevance of the resources. The TAC members identified resource evaluation as important as early as the first focus group meeting in January 2016.

Erik	How do you deal with the proliferation of resources that have come out? There’s just so many and a lot good … how do you decide?

Marty	When I started my year at Newcomer House, the previous TAC provided a list of websites that I should use in class and I ended throwing that list away by the end of the week because I hated every website. They had a lot of graphics, they had a lot of pop ups, a lot of “click here and win $1000!” kind of things and my students were so bogged down in those I didn’t want them on those websites because it detracted from our learning activities.

So, I think evaluation of existing materials would be a really important component of guiding the future TACs how to streamline beginning computer classes because even though we provide them with one online environment, we they’ve also got to find somewhere to do typing test and somewhere to practice their power point activities and X, Y, and Z. So, it would be a good idea.

(January 08, 2016 focus group)

However, in the June 24, 2016 focus group, when I asked them how they were choosing resources for their prototypes, it seemed that they had not done any formal evaluation.

Jen	So, we have decisions made about lay out and navigation. How are you guys evaluating what resources belong here? Yeah and is that [interrupted]
Marty	Trial and error
Erik	We need a whole day for everything.
Jen	Right.
John	Keep throwing stuff on the wall and see what sticks.
Jen	Trial and error?
Evan	Yeah.
Jen	Okay so I'm just going to say this out loud so we need … trial and error, I heard, throwing stuff on the wall see what sticks. We need a whole day to figure that out. So, would it be useful to have some sort of resource available to you to help evaluate the resources that you find?
Marty	Like if I had a check list, like this fulfils these needs, this does not
Jen	Need a check list. Okay.

It was surprising that trial and error was the strategy still in place in June, 2016. In response to these experiences and observations, I created an activity to help them craft a resource evaluation rubric. I introduced them to a framework published by the education non-profit, Achieve (www.achieve.org). The framework is used in K12 education to evaluate the utility of Open Education Resources. I also shared a somewhat dated but useful resource drawn on to evaluate the efficacy of self-access materials. The TAC members used tools to create their own rubric, which is partially featured in figure 4.18.

Online Resource Evaluation Rubric

Use this rubric to help you decide whether or not an online resource will work with your learners. It is based on past CTEP member experience and two popular sources: 1) the Achieve.org OER eval rubric and Tomlinson, 1988 (as recorded by Ciaffaroni, 2006). Copy the rubric and edit to fit your instructional needs.

	3- superior	2- strong	1- limited	0- weak	N/A
Alignment to Northstar Digital Literacy standards					
Quality of content explanations					
Utility for instruction					
Culturally relevant/not exclusive or bounded					
Quality of exercise & activities					
Opportunities for deeper learning; student can follow their interest/ opportunities for driving their own learning (self discovery)					

Figure 4.18. DiHo resource evaluation rubric sample

This work was completed in July of 2016, though the final version of DiHo was not completely stocked with resources until late fall of 2016. (See Appendix F for a list of the resources linked to, and Appendix G for the rubric that was created by the TAC members and the evaluation resources that informed the rubric). It is telling that though the rubric was available in fall of 2016, the TAC members did not report using it for resource evaluation. Rather, in a focus group discussion on November 17, 2016, Marty said that her process for evaluating resources was based more on the process of having created the rubric. That is, here experience in developing the rubric required a reflective process where she considered and prioritized resource characteristics and that this work created an internal guide that she used to evaluate resources, not the rubric itself. This reflexive process aligns with what M.W. Brown, an instructional designer, learning scientist, and researcher who focuses on teaching and learning using technology in educational settings observed about how teachers employ instructional resources. He wrote that teachers select materials then interpret them and plan how to use them based on the quality of the materials and their capacity to be instructive. He continued by suggesting that teachers then reconcile the potential of the material to their own teaching goals and their own teaching capacity and constraints of the environment. He wrote that teachers also attempt to make connections between what's available in the resource and the needs of the learner, constantly modifying adding or adding resources as needed (Brown, 2009). I note that I had initiated the creation of the rubric, not the TAC members. I suggest that this, along with the idea put forth by Brown that teachers are constantly gauging the efficacy of resources (even without a rubric), is perhaps why the rubric was not fully employed.

Discussion

The initial goal for study was the completion of an intervention, observation of its implementation and revisions, and an initial evaluation of it. The process of moving from Design Principles through skeleton structure through prototypes, and finally arriving at a final template made possible the articulation of a complete conjecture map. As mentioned previously, this project is characterized as research *through* design. What was learned through this design process can be framed as the design conjectures and theoretical conjectures that inform subsequent study of the resource.

The Conjecture Map

The high-level conjecture set forth at the beginning of the study remained relevant at its conclusion. It stemmed from not only the theoretical grounding but also concrete needs articulated in the needs analysis. The remaining aspects of the argumentative grammar of the eventual design were elucidated by following the shifts in the embodiment of the high-level conjecture that occurred over the design and construction process. These shifts in the embodiment that led to adjustments in the structure of the resource, which made possible the outcome. This led to corresponding shifts in the theoretical conjectures. These shifts can be retrospectively described by the conjecture map featured in Figure 4.19.

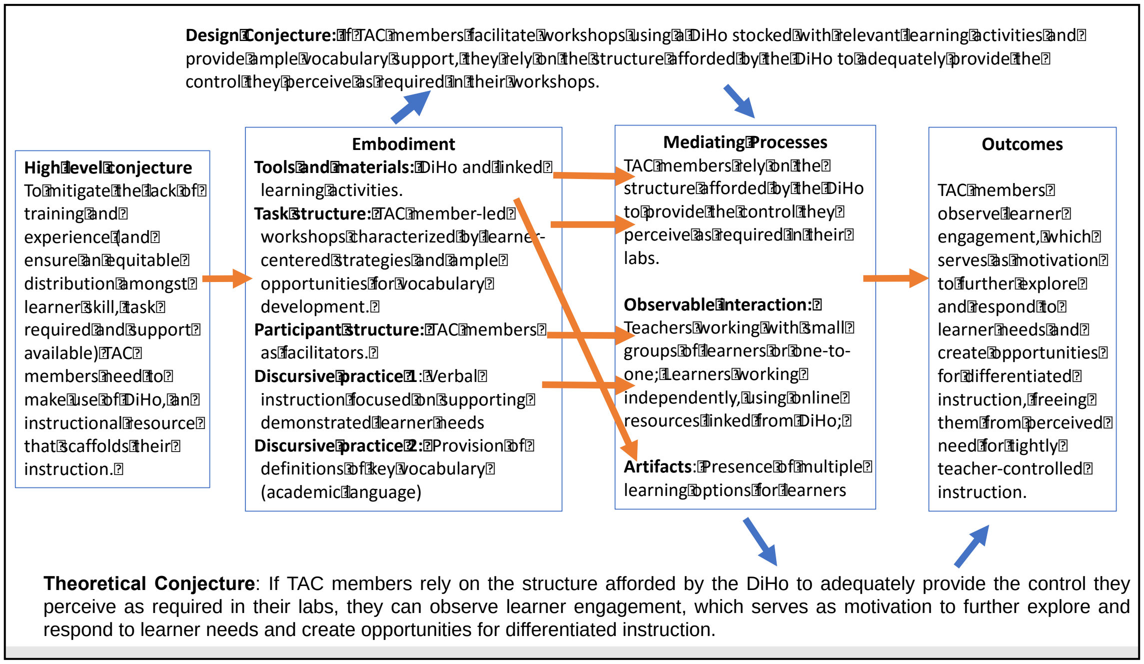


Figure 4.19. Conjecture map resulting from DiHo design and construction

The design conjecture that frames the required elements of the DiHo includes all of the components Sandoval (2014) suggests are involved with embodying a high-level conjecture. They are mapped in table 4.2 to the mediating process they initiated.

Table 4.2

Linked embodiments and mediating processes for DiHo

Embodiment category	**Embodiment**	**Mediating process**
Tools and materials	DiHo and linked resources	TAC members rely on the structure of the DiHo and give up some teacher-centered strategies;

		Presence of multiple learning resources for learner choice
Task structure	Workshops characterized by learner-centered strategies and ample vocabulary development	Same as above
Participant structure	TAC members facilitating not controlling	Teachers working with small groups or letting students work independently
Discursive practice	1) Verbal instructions in response to demonstrated learner need 2) Provision of vocabulary definitions	Teachers working with small groups or letting students work independently; Presence of multiple learning resources for learner choice

To arrive at the design conjecture that both described the work of this study and might serve as the springboard for subsequent use and testing of the resource, the embodiment and mediating processes are put together in an 'if then' statement: "If learners engage in this activity (task + participant) structure with these tools, through this discursive practice, then this mediating process will emerge" (Sandoval, 2014, p. 24). The foundation for this conjecture was the collective understanding gleaned from findings that addressed the study's research questions. The conjecture representing a summary of the items spelled out in Table 4.2 is mapped in Figure 4.20.

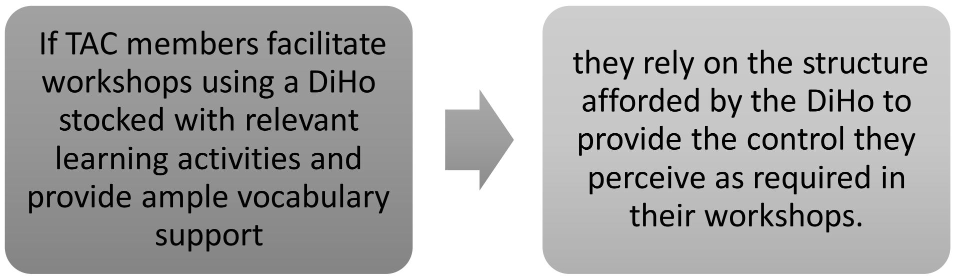


Figure 4.20. Design conjecture for DiHo

This design conjecture leads to the theoretical conjecture, the way that the mediating processes led to the desired outcome, or as Sandoval (2014) put it, "if this mediating process occurs it will lead to this outcome" (p. 24). The mediating processes spelled out in table 4.2 above can be summarized as a reliance on the structure of the DiHo to provide control within the learning environment, making it possible for TAC members to know what their learners are doing and gauge how they are faring. This led to the outcome, trust in the website and faith in the potential of differentiated instruction. The resulting theoretical conjecture is articulated in Figure 4.21.

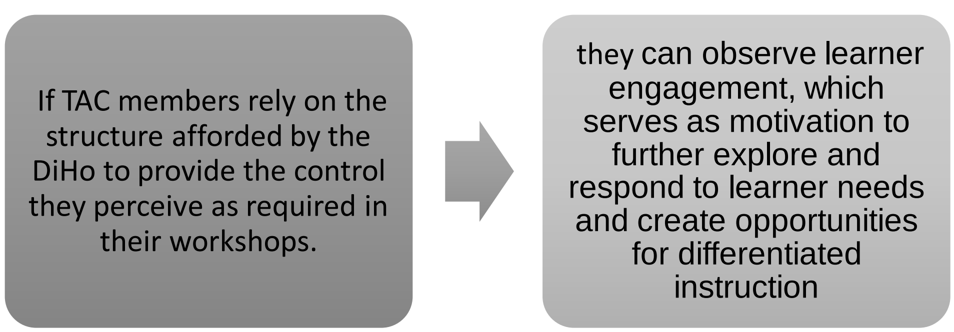


Figure 4.21. Theoretical conjecture evident in DiHo design and construction

The articulation of this theoretical conjecture serves an important theoretical niche for this DBR study. First, it serves as a domain specific theory. Cobb et al. (2003) suggested that such theory comes about through testing conjectures about learning and instruction. Developed with an orienting framework in mind, they are granular enough that they encompass more detailed aspects of research: “formulating, testing, and revising a hypothetical learning trajectory” (p. 83). Next, it serves as a springboard for further exploration of the instructional challenge in a new context.

Conclusion

Barba and Squire (2004), referring to anthropologist Clifford Geertz’s work (1976, 1983), noted the importance of research findings representing both “experience-near significance and experience-distant relevance” (p. 5). Because it developed both a local solution and developed knowledge on how to support the digital literacy of adult migrants, the design of the DiHo has both local and general significance. This study also aligned with the DBR requirement for development of *working* theories (Cobb et al., 2003). The research adds to current knowledge about construction and use of online learning environments by elucidating critical guidance required to support teachers, volunteers, and lab facilitators not formally trained as web-developers, who are nonetheless required to provide online learning resources as part of their instruction. It also contributes to knowledge about curating and evaluating materials and resources and characteristics of instructional strategies required to best support these learners. Through this work, two objectives have been achieved. The first is practical; the TAC members, together with me the researcher, constructed an instructional resource that made it possible for the TAC members to differentiate instruction and extend learning out of the classroom. Through this process, the second objective was achieved; new theoretical knowledge on the impact of design and resources on the practice of novice or untrained teachers. Both the local solution and the theoretical knowledge can be useful in other settings. Because the website design was informed by both prior research and the known needs in this context, subsequent AmeriCorps teachers teaching in these and other sites might employ it in their classes. Theoretically, this work has been useful because it points to required elements and implementation strategies to best support ELL adults working with minimally trained teachers. This research could, therefore, support new designs tailored to different audiences of ELLs.

CHAPTER 5: VOCABULARY OF COMPUTER BASICS (STUDY THREE)

This third study of this dissertation project investigates the issue of English as the primary language of instruction in computer classes held in community technology labs and frequented by English language learners (ELLs). Taking a functional approach to describe language I investigated instructional strategies employed to teach computer skills and the academic language used to do so. This study was motivated by the ideas that that learning specific academic content requires learning the language used to describe it (Lemke, 1990) and that if teachers recognize where and how vocabulary and specific linguistic structures are central to success with academic content, they can determine how to best provide support for comprehension (Schleppegrell, 2013). Schleppegrell (2004) suggested such success is characterized by command of the language used in specific academic contexts. Learner identity and investment in learning are deeply connected to command of academic language, including not only the vocabulary and language structures but also a broader communicative competence accomplished through use of academic language. Hence, in order to best support adult ELLs in digital literacy learning opportunities, teachers and tutors must be made aware of academic language and be prepared to scaffold learning to make use of it (Fitts & Bowers, 2013).

Background

As previously described, the technology rich society in the US calls on migrants to develop digital literacy skills. In the US, digital literacy skills are often taught in adult basic education programs, but the demand outpaces capacity for all learners. Community based organizations (CBOs) fill the gap but typically lack resources and trained teachers to meet the needs of English language learners (ELLs). To offer support for the instructors in these community technology labs it is necessary to focus attention on the role of language in learning of digital literacy.

The problem motivating this study emerged in the previously described pilot study, *Ubiquitous Technology: New Venues for Socially Constructed Identities*, described in more detail in Chapter 3. This was a case study exploring learner identity and investment in learning using Norton's poststructural SLA work as a theoretical framework. I found that digital literacy was a prioritized investment (illustrated in Figure 5.1) that learners assumed would be and expeditious means by which to move to toward other learning and professional goals. In their interviews, they articulated both work and college as a key motivation for wanting to build computer skills.

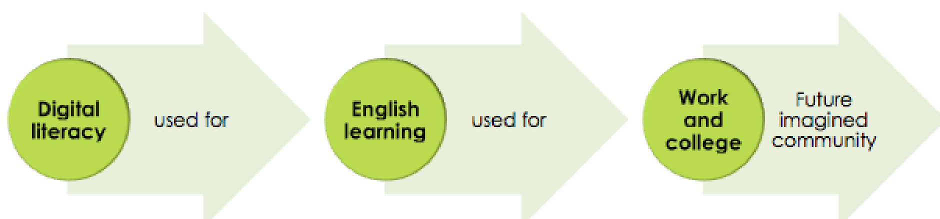


Figure 5.1. Digital literacy as a prioritized investment

However, classroom data showed that these investments were tested by several problems in the instructional environment, including over-reliance on teacher-centered instruction, visually challenging learning environments, and materials requiring higher levels of literacy proficiency than most learners possessed. Additionally, class observations revealed a pattern of instructional language not accessible to ELLs, particularly students with limited or interrupted formal education (SLIFE). For example, the overuse of unexplained culturally bound language accessible to only those who had previous experience with technology use (e.g., “PDF” and “flash drive”). The conclusion of the pilot study was that programs must mitigate barriers to engagement and learning so that learners see themselves as authentic participants in the computer classes. Therefore, facilitators working in these labs need resources to scaffold their limited training and instructional experience if the Required Elements Triad (see Figure 5.2) is to be equitably balanced.

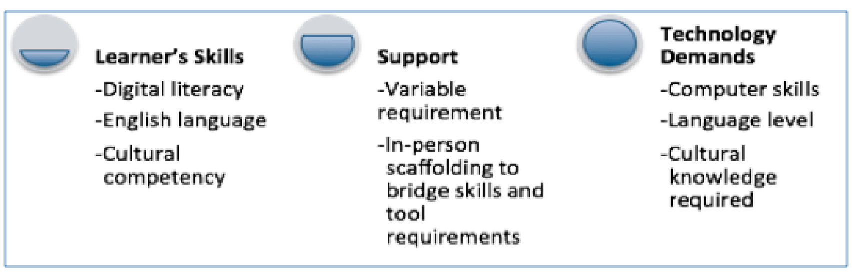


Figure 5.2. Silver-Pacuilla and Reder’s (2008) required elements triad

Hence, it was evident that a look at use of language was an important element to better understanding the support required for learner success w/in the Required Elements Triad.

Relationship to other Studies in this Dissertation

The study fits into two phases of the DBR larger study. It reports on salient information gleaned from all the gathered data, examined with respect to language use in computer skills classes. It is primarily part of the analysis and exploration phase, but also informs the design and construction phase the first meso-cycle of the Educational Design Research (EDR) described in detail in Chapter 2. Contributing to the analysis and exploration, the study identifies the instructional resources that helped the participants, the Technology Access Collaborative (TAC), support English language learners. For the design and construction phase, it informs actual development of the digital homeroom.

Literature Review

This literature review will touch on past research that together supports the argument that effective digital literacy instruction must attend to development of language required to describe skills that are the focus of instruction. It will begin with an introduction to Academic Language (AL) by tracing development of the approach to language learning and pedagogy from its early conceptualization to the present. Next, I share literature framing Systemic Functional Linguistics (SFL) as a theoretical framework for elucidating how meaning in AL rests on the impact of context. What follows then connects ideas from AL and SFL to current thinking about vocabulary and what it is to truly know a word. Finally, I will show how these frames, taken together show how a functional approach is important for understanding the role of language in digital literacy skill development.

Academic Language

Academic language is an important construct for considering adult language learning contexts, including those focused on digital literacy. AL is an approach to thinking about language that views the language of schooling as the means by which to support learning of academic content.

Gottlieb & Ernst-Slavit (2014) provided a useful current and very useful definition of AL:

> the language of school related to acquiring new and deeper understandings of content related to curriculum, communicating those understandings to others, and participating in the classroom environment. These understandings revolve around specific dimensions of language use including discourse, sentence, and word or expression levels within sociocultural contexts. (p.189)

The concept of academic language can be located in several theoretical perspectives in SLA: cognitive, functional, skills-based, sociocultural, and social action. The work stretches from early cognitivist work of Basil Bernstein (1971) and Cummins (1981) to the current work of Jeff Zwiers (2007; 2013), whose rich contributions to academic language in K12 setting show how support around academic language proficiency can support development of critical thinking skills and academic success. The brief description of AL traces it from its cognitive origins to the relevant application of it in this work, a functional perspective.

Cognitivism. Academic language has its roots in the early cognitive work of Bernstein and Cummins, both of whom wrote that the mastery of academic language was a cognitive task because it required the use of decontextualized language employed to participate in abstract tasks. Bernstein's (1971) research studying language use of working class versus middle class families in Britain resulted in an observation that there existed two types of language codes: elaborated code and the restricted code. The restricted code was used among insiders, people who shared an understanding of a topic. In contrast, when using elaborated code, one did not assume that the listener shared this understanding, and, consequently an elaborated code is usually more explicit or thorough. Bernstein (1971) wrote, “In an elaborated code, relative to a restricted code, the speakers explore more fully the resources of the grammar and therefore I considered there were more possibilities of combination” (p. 6). He went on to assert that an elaborated code was privileged and representative of stratification of society. One’s social position would determine which code a person could access and, in turn, employ in communication. This view diminished the relevance of home language or use of restricted, more generalized, less abstract home language in favor of elaborated code or complex use of grammatical structure, which Bernstein suggested was required to maximize theoretical thinking.

Cummins (1981) built on this work (Faltis, 2013) in development of his theories of Basic Interpersonal Communication Skills (BICS) and Cognitive Academic Language Proficiency (CALP). Cummins (1981) wrote that social language (BICS) is highly contextualized, unlike the language required for success in schooling, CALP, which is more abstract, less contextualized and therefore more demanding cognitively. Cummins suggested that speakers who are proficient in social discourse may not possess equivalent proficiency with academic language and that exposure to and instruction of academic language could help learners transfer their first language (L1) CALP to second language

(L2) CALP, if that language had been developed to a certain proficiency threshold. This would happen because of a "common underlying proficiency".

This view of AL from a cognitivist perspective limits its utility for developing pedagogy; it discounts sociocultural influences on language learning and perhaps feeds into privileging of AL over social language, reifying artificial separation between the two and situating it as a standard for English language proficiency. Faltis (2013) suggested that it is problematic to consider academic language as "cognitively and inherently superior to social language" (p. 4) because such a view illustrates the propensity for a deficit view of the linguistic assets learners possess.

Writing on AL took a sociocultural turn through the work of Gee (2001), who argued against labeling and separating one type of language for a particular context, one that likely exists as an elevated construct because of political and socio-economic reasons rather than its significance in one's linguistic proficiency. Gee (2001) put forth the view that language, no matter the context, is communication, and that communication is a social practice. Separating social and academic language and describing learner proficiency as such can socially stratify learners based on the language they use at home or the varieties of language they have learned outside of school. This separation is artificial given the social language required in all contexts, even in the learning of academic content, where registers of language fluctuate.

Faltis (2013) referred to several useful examples illustrating this perspective of AL, including Wong Fillmore's (1982) research-based observations on the benefits of teaching classroom language, where teachers teach language for managing a classroom and in support of instruction of content. Lemke (1990) wrote about academic language as social practice. Lemke asserted that students learn academic content by participating in activities and conversation required of experts in an academic field. These activities require display of language competency situated as socially constructed conventions about how to communicate knowledge in specific contexts. Each of these authors approached support of ELL success with academic content from socially situated context.

Other research refined the sociocultural perspective by adding a functionalist approach to it. Mohan's (1986) research supported viewing language and content as knowledge structures represented by or accessed through different language functions. By learning the functions, learners can access and display the knowledge that they have. Schleppegrell (2004) argued for an approach that drew on a sociocultural theory (referring to Vygotsky, 1981) and the perspective that language is a tool that mediates social interaction. She, too, critiqued assertions that school language was more complex, explicit, and decontextualized than social language; she suggested that such views were unfounded if language was viewed from a functionalist perspective where all language might be seen as contextualized. Schleppegrell, also provided a critique of the sociocultural view, writing that it was useful for describing the challenges faced by learners whose home language differs from schooling, but that it failed to provide a description of the school language itself. Her work is influential because of the way it connects AL to an early turn in linguistics that shifted focus from structure of language to functions and meaning; the work of (Halliday, 1985; Halliday, 1993; Halliday, 2003).

Theoretical Framework: *Systemic Functional Linguistics (SFL) and Academic Language*

SFL is a useful way to think about how AL helps us understand how language is contextualized and disciplinary. Halliday's functional linguistic theories provided the means to operationalize the work of sociolinguists Dell Hymes, who called for linguistic theory that united the study of linguistic structures and social context (Schleppegrell, 2004). SFL can do this because it provides a means to describe language based on how it is used in a given context. This focus on use and context situates language as a social process or social semiotic rather than a psychological reality. Halliday (2003) wrote, "language realizes culture in the way that, within language, sound realizes wording, and the realization of wording in sound, in its turn, realizes meaning" (p. 436). He developed a case for this perspective by describing language as a construct that helped shape reality and therefore could not be divorced from meaning.

In describing the means by which language shapes reality, Halliday drew from Saussurean traditions in linguistics that take functional (use) and semantic (meaning) perspectives as opposed to an approach to describing language that is more formal or syntactic (structure). Because meaning is construed by context in SFL, language is considered at the textual rather than the sentence level, and focus on analysis is on language use rather than grammaticality (Halliday, 1993; Halliday, 2003). Most SFL studies, consequently, make use of whole-text as a unit of analysis (Mohan & Leu, 2005). It should be noted here, that I think this is a gap in the research that I hope this current work addresses by application of SFL to lexical study in the context of a computer class.

Understanding the component parts of SFL is important for knowing how they work together. Halliday (2003) wrote that he drew on Firth (1957) for the concept of system, which is defined as a constellation of structures used to represent particular meaning in different scenarios or contexts. In Halliday's view, linguistic systems provide the background for grammar or structure, and grammar can be described as the result of sets of options available or appropriate for use within diverse paradigms. According to Halliday (1993), a systematic grammar represents functions that language evolved to serve. As such, the structure of a language is an organically evolved "configuration of functions" (the systems) that came to be because of what was required of language. Halliday called this a latticed structure or a system network, in which relevant systems are drawn upon when making meaning (Halliday, 2003).

SFL is "functional" because it frames use of language within the context of functions that language must serve. The functions shape or influence the structure and organization of language. Consequently, grammar is an abstract representation of functions that language must represent and language is comprised of functional input and a structural output, creating the system for different functions to be assembled into an adult utterance. Halliday organized these functions as categories called metafunctions, which illustrate how human language evolved naturally from a need to make meaning:

ideational (using language to info, which is the focus of this work), interpersonal (using language to relate to others), and the textual (mapping semantic components into discourse) (Halliday, 1993; 2003). These metafunctions represent systemic clusters, or groups of systems that make similar types of meaning.

These metafunctions combined define the “dimensions of semantic space” (Halliday, 2003, p. 436). They occur simultaneously and the meaning they reflect is determined by the social context, where they combine and are hence represented in language through its grammatical structure. Indeed, all are required in order to represent meaning potential of an utterance. The choices made and the resulting use of structure, or construed meaning from structures evident in a text or utterance, is manifested in what Halliday (1978) calls register, “a set of meanings that is appropriate to a particular function of the language, together with the words and structures which express these meanings” (p. 195). Halliday categorized different aspects of a context that inform variation in register: field (topic), tenor (relationship between interlocutors), and mode (expected structure of a text or utterance). Meaning is expressed/construed through an alignment of functions and register in different contexts, thus linking function and meaning through a grammatical expression.

Halliday (2003) suggested that learning and demonstrating knowledge is actually learning to mean, and you cannot learn to mean unless you can express that knowledge through language, so teaching a person the language required in a given context can help them gain knowledge (Halliday 1993). SFL is, thus, a useful means to elucidate the language of schooling and perhaps scaffolding learning for learners. For example, Halliday (1978) constructed what he termed "mathematical register" (p. 195), the particular meaning of language when used for communicating about mathematics.

Schleppegrell (2004) adopted a functional approach in her work on academic language. Successful application of AL requires identifying the configuration of grammatical structures that are typical, expected, or socially relevant in any context. By doing so one can define the register, "the configuration of lexical and grammatical resources which realizes a particular set of meaning" (p. 46). Drawing on Halliday, Schleppegrell (2004) presented the following structure for organizing elements of a register.

TABLE 3.1
Grammar and the Context of Situation

Contextual Variable	*Linguistic Realization*
Field (Presenting ideas)	Ideational Choices Noun phrases/nominal groups (participants) Verbs (process types) Prepositional phrases, adverbial adjuncts, and other resources for information about time, place, manner, etc. (circumstances) Resources for marking logical relationships
Tenor (Taking a stance)	Interpersonal Choices Mood (statements, questions, demands) Modality (modal verbs and adverbs) Intonation Other resources for evaluative and attitudinal meaning (e.g., resources for appraisal)
Mode (Structuring a text)	Textual Choices Cohesive devices, including conjunctions and connectors Clause-combining strategies Thematic organization

Note. Based on Halliday (1989, 1994).

Figure 5.3. Schleppegrell's Table 3.1 Grammar and the Context of a Situation (2004, p. 47)

These variables, field, tenor, and mode (which are described above) work together in a context to define the shape of discourse that efficiently or accurately expresses meaning within it. By attending to the variables of field, tenor, and mode, we can explore or understand linguistic structures evident in different social contexts, and thus define the language of schooling (Schleppegrell, 2004). Further, she wrote,

> By recognizing how different linguistic choices are functional for construing experience, presenting one's perspective and constructing particular kinds of texts, we keep the focus on the role of language as a social force… enabling the teacher to be proactive in new ways in helping students learn the way language is used to construe knowledge in different subject areas (p. 6).

Schleppegrell (2004) argued that teachers need to help students master the variety of language required for an academic discipline by teaching both form and meaning. A functional analysis of that language is necessary in order to elucidate the language required to display knowledge. Though there is some common ground with the more cognitive-based approaches to SLA, this functional approach suggests that the motivation for and utility of such scaffolding lies in the learner's prior experience, rather than in input, as a cognitive approach suggests. Alternative approaches to defining the language of schooling, such as corpus linguistics which study frequencies of representation Gries (2009) or cognitive approaches concerned with input, are less explicit with respect to social orientation. It is this difference that makes functional linguistics a more useful springboard for shaping pedagogy.

Because there is so little research on use of SFL with adult ELLs in any context, we must look to other literature for situating this work. There is literature drawn from K12 research that is useful, including AL research conducted from a functional approach. For example, Schleppegrell (2011), in the California History Project, investigated linguistic features drawn upon for teaching history, particularly around analysis of history text analysis and the language of questions prompting discussion of them. More recently, Schleppegrell (2013) employed SFL to first define metalanguage on grammatical mood and function, and transitivity in the very clauses, and then employ the language to support elementary ELLs in English language arts programming in support reading comprehension and writing.

What is it to Know a Word? Literature on Vocabulary

Understanding a parallel line of inquiry on vocabulary teaching and learning is necessary to frame the instruction written about in this study. Though much of it focuses on either K12 or higher-level L2 vocabulary development, it is useful for theorizing the role of vocabulary with low-level ELLs in computer classes, particularly the literature that characterizes what it means to have knowledge of words. Knowing a word is complex endeavor encompassing different types of knowledge. Graves, August, and Mancilla-Martinez (2012) described it as a mix of receptive and productive knowledge. Knowing a word is also understood as a continuum Beck, McKeown, and Omanson (1987), as illustrated Figure 5.4.

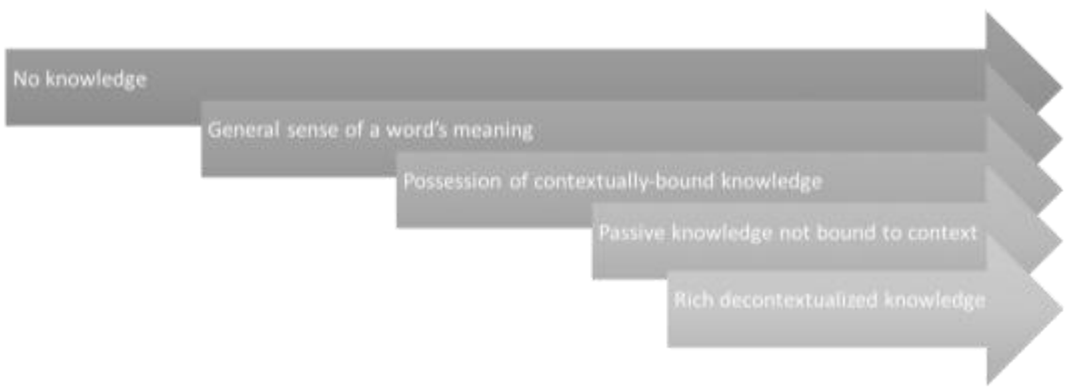


Figure 5.4. Continuum of word knowledge (Beck, McKeowan, and Omanson; 1987)

A person starting with no knowledge of a word gradually progresses to eventually understand its meaning and make use of it in a variety of settings. Knowing a word may also mean knowing the connection of words to broader concepts, topics, or situational discourse where words are relevant or useful (Miller, 1978 as described in Beck, McKeown, and Kucan, 2013).

Perfetti (2007) in his writing on lexical quality hypothesis, articulated specific features required to true know a word, for example: semantics, phonology, orthography, morphology, and syntactic rules. Perfetti also suggested that hearing a word and becoming aware of its meaning likely triggered mental connections to past experiences or relations to prior knowledge and that the resulting abstract representation made it possible to make meaning of a word in a new context. If one could draw on relevant prior knowledge, he or she was essentially providing a form of familiar context, cuing a personal schema to support understanding the word. This is a problem for learners touched by my study, who had little prior knowledge with the content, which made connections to schema either difficult or not possible at all. Also challenging for my learners was the number of exposures required to learn a word. Graves et al. (2012) wrote,

> … studies of learning from context show that context can produce learning of word meanings for both native English speakers and ELLs, that the probability of learning a word from a single occurrence is low, and that the probability of learning a word from context increases substantially with additional occurrences of the word (p. 21).

So, how might one overcome this challenge? Beck et al. (2013) pointed out that students needed to develop an interest in learning vocabulary, to encourage them to notice new words in their environment and to start to reflect on how words are related conceptually. Atkinson theorized that, from a sociocultural perspective, learning is “a default state of human affairs. If we constantly and sensitively adapt to our environments, then learning is continuous, at least insofar as durable adaptive change occurs in the learner– world system" (Atkinson, 2011, p. 144). So, tuning-in students to representations in their daily life of the skills and vocabulary they hope to master can support learning.

How a functional approach is important for understanding digital literacy for adult ELLs

Second language learning of adults, while conceivably related to L1 acquisition or L2 development of children still in formal school is significantly different (Collier, 1995; Gee, 1994). For adults, it is perhaps made more complex given adult learner positioning in the larger society, where they have jobs, families, and responsibilities that compete with learning, and their identity as language learner is perhaps secondary to these other aspects of their daily life. Further, for many adult L2 English learners in the US, learning is shaped not only by these factors but also by previous limited educational opportunities and turbulent personal life experiences (Bigelow & Schwarz, 2010; Decapua, Smathers, & Tang, 2009; Marshall & DeCapua, 2013; Wrigley, 2011). Understanding that from a sociocultural or functional perspective lived experience can be viewed as a springboard for future learning, teachers of adult ELLs may need to provide the means by which learners can develop schema to support learning.

Utilizing academic language as a means to support the academic development of adult ELLs provides scaffolding that supports language development, the learning of content knowledge, and nurtures identity as students. For example, in an age of technological ubiquity, where learners have been found to privilege building computer skills over English language learning, as pointed out in Chapter 3, a pedagogy based on known academic language can invite learners to participate in language skill development that at the same time gives the valuable skills needed to participate in daily life. Hence, AL holds promise as a means to provide adult ELLs with relevant input to engage as a both a learner and legitimate participant in broader world by elucidating the language required to fully engage in learning by affording the cultural capital the language holds (Pierre Bourdieu, 1991). Zwiers (2013) wrote that such capital is critical for knowing what to say, do, or write in an educational setting. Because there is a gap in research for adult migrants working in the context of digital literacy classes, the goal of this research was to answer the following questions:

1. What are the particular lexical structures (i.e., vocabulary) evident in classroom discourse of digital literacy?
2. How do corps members draw on key vocabulary in their instruction?

The methodology employed to answer these questions is described below.

Methodology

This is a qualitative case study of the language used in instruction in two basic computer skills classrooms in two of the six focal sites represented in the larger dissertation study, Newcomer Home and Ascend. Case study is commonly employed in SFL research, where context is critical for determining meaning of language. (Schleppegrell & O'Hallaron, 2011). For this study, I focused on representations of "field," the ideational choices presented in instruction in the two sites and by comments about teaching made by the participants in focus group discussions. Particularly important in this context are those nouns and verbs that constitute the vocabulary of the basic computer skills classes observed. Vocabulary is an important component of ideational choices in language use. Schleppegrell (2001) writes

> Vocabulary is an obvious feature of register differences, as it is the lexical choices that realize the ideational content of the text. Through lexical choices, students also situate themselves as members of particular discourse communities, displaying their ability to adopt the lexis of the field. (p. 438)

The study sought to define the vocabulary employed in basic computer skills classes.

Methods

To account for the vocabulary required for participation in basic computer classes, I analyzed data from recordings of classroom observations and focus group discussions, which included data from conversations where participants described their beliefs about the role of explicit language instruction in the classroom and the relationship between English language proficiency and digital skill development. I took note of language used to describe the content skills that served as the focus of skill instruction, the explanatory language used to make those content skills clear, and instructional strategies employed to teach them. I also analyzed any artifacts employed in instruction of the focused computer skills. This data is reflected in Table 5.1 below.

Table 5.1

Data collection supporting functional language analysis

Method	Focus group and interviews	Classroom observations	Presentations
Number of Sessions	17 sessions	15 sessions	3
Hours transcribed	13 hours	22.2 hours	0
Supporting materials	n.a.	Class handouts, photos of learning environment	Power Point slides

Sites and Participants

All of the TAC members introduced in Chapter 2, except Leanne who was only available for the pilot study, participated in the focus group discussions as part of the larger study, but the data presented here draw primarily on contributions from the two participants who provided instruction to low-level ELLs, Erik and Marty. At Ascend, Erik offered classes to adolescents and adults supporting workforce training and computer skills with the goal of helping community members achieve economic and social stability. Instruction in the computer lab was characterized by a rolling cohort with very few learners coming every day and no way of knowing who will attend each day. Marty's work Newcomer House was a bit different, in that Newcomer House enrolled ELLs in formal English language learning and provided computer classes to supplement language classes. These computer classes were several weeks long and supported a cohort group of students that remained largely intact throughout the course, with new students joining in along the way.

Analysis

Data were qualitatively coded in a multicycle process (Sal dana, 2012). In cycle one, I applied structural codes, for example *Language analysis, Instruction of content,* and *Needs* to draw out data that represented use of language or instruction of the language or digital literacy. First cycle coding also included what Saldaña referred to as attribute codes, used for marking useful demographic information about learners and context, for example: *Student info, levels, ELLs, class demographics.* I took a second pass still drawing on first cycle codes for as Saldaña (2012) suggests, "a more attuned perspective (p. 10). During this phase of coding, I applied descriptive codes to flag immediate salient themes within this subset. Table 5.2 shows the codes employed in both cycles that are most relevant for this part of the research.

Table 5.2

Study 3 Codes observed in qualitative coding process

Code Sub-codes	Code Sub-codes
1. Instruction of content	2. Student Info
Process of Instruction	Levels
Review	ELLs
Using student home language	Class demographics

Classroom management	3. Language Analysis
Individual Help	Conceptual understanding
Cohort model	Teaching Vocab
Transferrable skills	4. Needs
Display questions	Multilingual
Activity	Class logistics
Resources	Differentiation
Use of Northstar	
Articulation of skills	

In the table above the four numbered codes in the table above are the parent codes, with their attendant sub-codes included beneath each one. A codebook defining these codes is included as Appendix H.

Findings

The analysis of these data suggested that determining the bounds of an academic language "field", or vocabulary, is not a straightforward endeavor. Though there was a common informant shaping key vocabulary, an assessment, that determined the "ideational field", the explicatory language meant to support skill development varied. Further, the treatment of key vocabulary became more sophisticated as the project progressed.

The Language of Computer Skills Instruction

As I analyzed field notes, analytic memos, transcriptions of focus groups and class observations, and classroom artifacts to answer the question: *What are the particular lexical structures (i.e., vocabulary) evident in classroom discourse of digital literacy?* I noticed ample data that informed identification the key vocabulary in this context. This is illustrated in the table below, which shows the frequency of codes (the first row of the table) for each data source.

Table 5.3

Occurrences of codes in data gathered from Ascend and Newcomer House

	Language Analysis	**Vocabulary Inconsistency**	**Teaching Vocabulary**	**SUM**
Instructional Materials	0	0	13	13
Focus Group Notes and Transcripts	11	1	29	41
Observation Notes & Transcripts	106	4	35	145
SUM	121	5	77	203

Diving into each coded group of data revealed a common theme; these data suggested that the ‘field’ in this context was constituted by key vocabulary articulated in skills tested in the Northstar Digital Literacy Assessment. Each of the participating agencies used the assessment as an outcomes measure, TAC members were encouraged to provide instruction that supported growth on the assessment. The standards on which the assessment is based, therefore, motivated the vocabulary used in the classroom. Evidence for this finding was most neatly reflected in a comparison of the instructional materials from the focal site, Ascend, and the actual Northstar standards. The data are summarized in Table 5.4 below (See Appendix I for a complete list of the standards and the vocabulary used in the materials).

Table 5.4. *Coincidence of key terms and concepts in course materials and assessment standards*

Skill area	Number of times class terms are articulated in both standards and materials	Number of times class terms are articulated only in materials; but implied by standards*	Number of standards not covered in class materials	Number of terms articulated in class materials but not in standards
MS Word	24	3	5	2
Computer Basics	26	12	6	0

*Terms used in course materials reflect more detail than what is articulated in the standard, but teaching standard necessitates use of the term.

Table 5.4 shows that that there was a high correspondence of terms that appeared in both the Northstar Digital Literacy Standards and the course materials for both MS Word and Computer Basics, the classes that I observed several times at Ascend[9].

The Northstar Digital Literacy Assessment for MS Word is built on 17 standards; the Computer Basics assessment is built on 20 standards. The standards are broadly written, so Table 5.4 does not show a one to one correspondence between a term used in class and a standard; in fact, several standards are counted more than one time in this analysis, which is why the numbers in column two are greater than the number of standards for each category. For example, one Microsoft Word standard, "Align text: left, center, and right justify" was counted four times to account for each of four terms (alignment, center, left, and right) in the class materials. Additionally, column three of the table shows there were terms included in the course materials that constituted part of a larger concept suggested by, but not explicitly stated, in the standards. For example, in the Computer Basics lesson, the term "loading" is introduced as a cursor icon form; though "loading" is not explicitly stated in the standard, it fits within the standard, "Identify mouse pointer shapes and match them to the correct context of use: typing arrow (text), arrow (basic clicking), hand pointer (clickable links)".

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[9] There were several terms that were included in the standards, but not covered in class. These are less commonly used affordances of MS Word and so were not taught, for example customizing mouse control and adjusting screen resolution.

Varied Language Employed in Explanations. Beyond the focus on vocabulary motivated by the assessment, there was not much consistency in the language of explanation that TACs provided to support instruction of the skills. At Ascend and Newcomer House, explanations that students received for different skills generally started with a group presentation led by the teacher and then shifted to individual practice supported by one-to-one help when needed. Explanations provided in the whole group instruction were hardly ever just explicitly articulated, but were supported by slides and demonstration of the skill. The one-to-one support that followed depended on the learner's needs, from casual observation to literal handholding as the facilitators monitored practice.

Each corps member seemed to tailor their explanations to their community of learners. Because these students varied, the explanations had to vary too. Additionally, each of the sites had volunteers who volunteers came with their own way of describing things. An example of this variation can be seen in the following classroom transcript excerpts from a Microsoft Word text formatting lesson at Ascend represented in Table 5.5.

Table 5.5

Transcript excerpts showing varied explanatory language (Classroom observation, April 4, 2016)

Minute	Speaker	Excerpt
17:25	Volunteer	Try swiping that
17:42		Swipe

17:53		Put your cursor here and swipe	
18:00		No. Put your cursor here. Now swipe.	
20:30 - 21:02	Erik	1	So, highlight all of your text, we’re going to do copy
		2	paste and cut. So, if you highlight all of your text. So,
		3	you want to click. So, make sure you click and
		4	highlight. Try copy. So, if you highlight and try the
		5	copy button. Go to the end of that one and then you
			click right there.
21:30 – 22:19	Volunteer (S = student V = volunteer)	1	V: Now try this again. Click copy, click copy.
		2	S: Yes.
			V: Now move your cursor here. Click enter. enter.
		3	now do paste. See what happened?
		4	S: umm.
		5	V: see it put in twice.
		6	S: I see.
		7	V: [moves on to new student]. Ok are you ready for
		8	copy and paste? Ok. Do, hold your cursor here. Click.
		9	Hold. Move your hand.
		10	S: Right here?
		11	V: not quite. put it there. Hold your finger down and
		12	move your mouse this way. Yes, yes. Now copy. Ok.

		now. cursor goes here. you copied this. Now put your cursor there. paste. V: See, you swipe it, copy. paste. now you have it twice.
22:38	Volunteer	You swipe it. Copy. Then paste.

These differences were elucidated in the data by applying in vivo coding (e.g., swipe) of data labeled with the code *Individual help* in the cycle one coding and then comparing the language employed by the different helpers in the classroom. In this short excerpt, the instructor, Erik, and the volunteer, were recorded using different explanatory language to support the development of a skill, almost simultaneously. Where Erik consistently used the word “highlight”, as he had in his presentation of the lesson, the volunteer relied on different language, including “swipe” repeatedly.

Teaching Vocabulary in Computer Classes

The end goal of this functional analysis was an understanding of the key vocabulary employed during instruction in computer classes. The second focus of inquiry, then, investigated whether or not and how the vocabulary of computer skills was made accessible to learners by answering the following question: *How do service corps members draw on key vocabulary in their instruction?* The data from the two sites serving low-level ELLs, Newcomer House and Ascend again, provide the most elucidating data. The most useful finding presented here was a shift in the corps members' perception of the role of vocabulary development in instruction.

Starting point: Vocabulary not a focus. At the beginning of the study, these data suggest that vocabulary instruction was viewed as secondary or attendant to the skills instruction, rather than the focus of instruction. For example, in the first focus group meeting there was an acknowledgment that language was an issue in teaching computer skills, but there was no conversation about how language instruction or vocabulary support should figure into instruction. This finding is demonstrated in a conversation between Donna, who worked with intermediate to advanced level students with ample past educational experience at Global Institute, and Erik the participant who worked with SLIFE learners at Ascend.

1	Donna	I'll explain something in English and one of them with higher proficiency
2		in English and who gets the concept will turn to others and will explain
3		everything I just said in Somali. And they'll be like OK I understand. So,
		the goal is for them to take that home [inaudible].
4	Erik	That's almost want you want to have happen in a classroom. What you
		just described.
5	Donna	Yeah
6	Erik	That's I think maybe best case scenario, though maybe the one thing you
7		hope for is that then eventually they start learning terminology to
		associate with that concept.

(Transcript from focus group, January 8, 2016, minute 3:40)

The transcript shows that there is an awareness that language comprehension is an issue when teaching computer skills in L2 English and that conceptual understanding is the goal of instruction. In lines 1 and 2, Donna provided a strategy (i.e., relying on a more proficient learner to leverage L1 for explanation) and Erik suggested the desired outcome of that or any strategy they employ in their computer classes is a conceptual understanding of the skill associated with the language. His comment in line 6 illustrates his belief that terminology is secondary to skill, that "eventually" acquisition of the vocabulary will happen.

Early shift: Considering vocabulary. Language was not again represented directly in focus group data until two months later. In answer to the prompt from the researcher, "So, let me ask a follow up question; you guys have talked about technology as the content. To what extent is English language the content that you're teaching? What do you think?" The TAC member answers represented in the transcript suggest that there had been some growth in their understanding of the role of vocabulary specifically in the instruction of computer skills. Erik responded as follows: "*The first day of my class in particular is just, what is this called? It's called a mouse. What is this called and then to learn the functions before that they have to understand why it's called that…"* (Focus group transcript, March 18, 2016, minute 9:07). Note that though the question asked about language more generally, the response was focused specifically on vocabulary.

Later in the same transcript, there is more data representing how they approached the language issue at the time, again showing vocabulary as a focus. This final except shows further evidence that the focal participants, in this case Marty, were beginning to think about skills and vocabulary as connected.

1	John	But I like the way in your class you talk about vocabulary even though
2		it’s technology it’s vocabulary [To Donna; John had just observed her class.]
3	Jen	Marty does the same thing too.
4	Marty	Yeah and so I started integrating okay if we're going to talk about there
5		will be some new vocabulary and I will introduce and say, "Okay this is
6		the new word for… this is the new… this is a new word." and then I can
7		see them writing things down on their handouts that I gave them and that kind of stuff.

(Transcript from focus group, March 18, 2016. Starting at 11:38)

Classroom observation data also support these observations about early efforts to integrate vocabulary in support of computer skills, and how their work shifted over the months of the research.

Recognizing the importance of vocabulary instruction. Data from both Newcomer House and Ascend suggest that as time progressed Marty and Erik began to allow more time for focused instruction and practice of vocabulary and attendant skill development.

Erik's work at Ascend. Data from three parallel lessons taught by Erik show how his thinking about vocabulary building shifted. In the first lesson, taught on April 4, 2016, vocabulary was embedded into the skills instruction. This finding was elucidated through descriptive coding process applying the labels: *Activities*, *Articulation of skills,* and *Vocabulary instruction.* In his lesson, key terms were included on PowerPoint slides projected to a presentation screen, as seen in Figure 5.5, and introduced as he talked through the slide. This instruction included some provision of definitions and comprehension checks done with display questions all supplied in large-group cohort instruction.

Figure 5.5. Power Point slides shown by Erik at Ascend on April 4, 2016

The slide shows a screenshot of the Ribbon in Microsoft Word, seen along the top of the screen. Underneath that, it shows blown up images of the formatting options featured on the ribbon, for example B, I, and U, which are labeled underneath the icons (i.e., “Bold”, “Italics”, and “Underline”). This intentional but very limited introduction showed some effort to support vocabulary development; however, vocabulary was not the focus of the class.

Data from Erik’s class on the same topic three months later shows that over time, Erik began to integrate activities to support vocabulary instruction in more ways. This shift is evident in Table 5.6 below, included here to provide an overview of the range of instructional activities observed in the class. Each of the activities listed will be further analyzed below.

Table 5.6

Instructional strategies used in Erik’s parallel lessons on text formatting in Microsoft Word

Instructional Activity	April 4, 2016	June 17, 2016
Vocabulary instruction embedded into skill explanation.	x	x
Power Point slide showing skill and key words	x	x
Demonstration		x
Several words and concepts presented simultaneously	x	
One word or concept presented at a time		x
Vocabulary worksheet	x	x
Supplemental vocabulary and review activities		x

Practice skill	x	x

The table shows that the class taught on June 17 included each of the instructional activities observed in the earlier class, plus a demonstration and extra vocabulary review activities. It also featured concepts presented one at a time, rather than several terms at once, as happened in the earlier lesson. The following excerpts from classroom transcripts analyze this difference in the lessons. These data were uncovered through application of the codes articulated in Table 5.2 above, particularly: *Process of instruction*, *Classroom management*; *Articulation of skills*, and *Teaching vocabulary*.

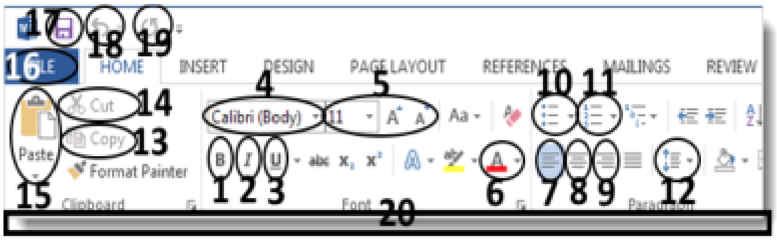
The first excerpt shows Erik teaching a chunk of vocabulary and skills together, without much time for practice or review of either the skills or the words.

1	Erik	What you see up here on the top of your bar on the page is called the
2		ribbon. That's just a reference point. Do you remember that one
3		XXXXXX [calls on a student]? The ribbon? So, this entire thing here
4		is the ribbon. So that's what we're going to reference throughout the
5		program. The ribbon. It contains all formatting changes. So, the first
6		one we're looking at is right here. And you can look on your screen.
7		There's a B, an I, a U. So, who can tell me what this B is? [No one
		responds] Bold. So that makes it thick, darker. Next one, I?
8	Student	Italics.

9	Erik	Italics, yep. Italics slants it to the left and makes it look fancy. Next
10		one, what do you think? [No response.] Underline. Yep, so we'll
11		practice these three. If you want you can write the numbers
12		corresponding to each, so 1, 2, 3 [on the worksheet]. You can practice
13		these. Bold, italics, and underline.
13	Volunteer	Do you want them to actually type the word?
14		
15	Erik	So, I was going to first have people write it so they know the
16		corresponding and then afterwards.

(Transcript from classroom observation, April 4, 2016. Starting at 10:14)

As indicated in the transcript above, Erik introduced vocabulary in embedded definitions that were provided as the skills were introduced for the first time (see lines 1 through 9). Also, note that "Underline" was not explained at all. In lines 3, 7, and 10 you can see display questions checking for understanding of the vocabulary. After all the concepts were introduced, Erik instructed the students to write the new terms on their handout (pictured in Figure 5.6 below) and then asked them to move to working in their Word documents.


Assignment 5 - Microsoft Word Ribbon

Match the number of the key to its name and function

1. **Makes text darker** ________________
2. *Makes text slant right* ________________
3. Puts a line under text ________________
4. Changes the style of font ________________
5. Changes how big or small text is ________________
6. Changes the color of font ________________
7. Puts text on the left of the page ________________
8. Puts text on the center of the page ________________
9. Puts text on the right of the page ________________

Figure 5.6. Excerpt on formatting Word text from Erik's classroom handout.

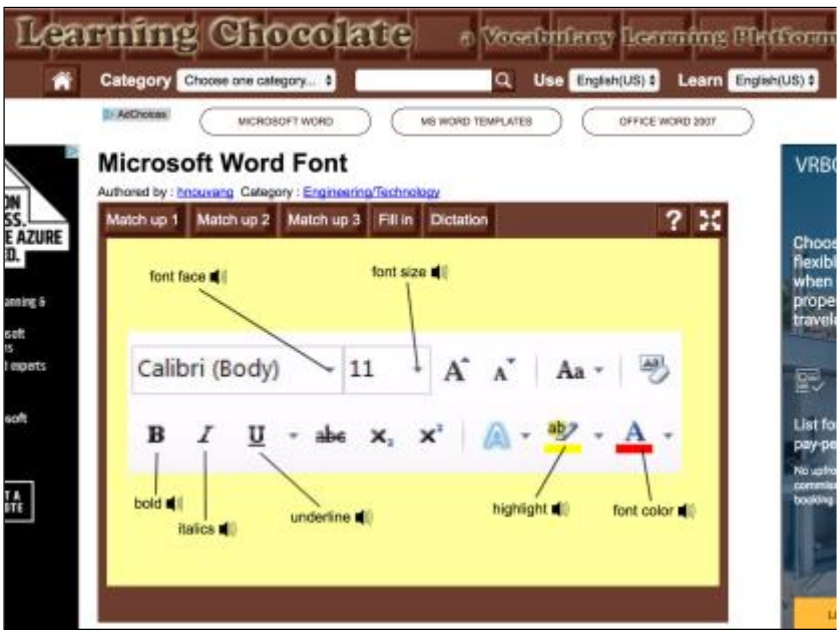
The same lesson was taught again on June 17, 2016. The excerpt of the classroom observation transcript, particularly the text treated with codes showing shifts from *Cohort* to *Individual instruction*, shows a wider range of opportunities for learners to work with one concept at a time.

Erik Ok so this will be new material for you [to new students], but I know you've [different student] already gone over this, but it will be good for you. So, we're going to go over some parts of Microsoft Word. [Passes out new handout to new students].
Alright so the first one we're looking at is B up here [points to B on the projected slide]. The B stand for Bold. So, you can write the word bold.

7		[Pauses for students to write the word on the handout and type on their computers.]
8		
9		This has lots of words on the page [referring to handout]. I think it’s like
10		20 long, so we’ll need a break. Now try it. [Jen and Erik walk around the
11		room to get students to type and try out making a word bold]. Ok we got bold.
		The next one, I, stands for? remember this one?
12	Student	Italics.
13	Erik	Italics yep. So, the second one is italics. [Jen and Erik walk around the
14		room to get students to type and try out making a word italicized].

(Transcript from classroom observation, June 17, 2016. Starting at 7:04)

In this example, Erik had the students try out each of the skills as he introduced them. Erik said the word, and while pointing to the projected slide, explained it, and then asked students to write it on their handout, type the key word, and then apply the focused formatting skill. After this sequence for each of the words, he followed with a review of the vocabulary and skills covered, which included six words in total. Because there were pauses between the introduction of each concept and a review opportunity at the end, this lesson opened up the opportunity for more differentiated explanations of the skill and vocabulary, and better supported learner needs that the previous lesson. Additionally, as students demonstrated a need for more individual help, he or a classroom volunteer referred them to extra online activities housed in the Digital Homeroom, the website that is the focus of Chapter 4, which was available for students to access. It contained additional practice that provided support with skill and vocabulary introduction, including a link to external websites like the one pictured in figure 5.7, which is an online activity drawn from a website with topically organized lessons on English language vocabulary.



(http://www.learningchocolate.com/content/microsoft-word-font)

Figure 5.7. Web resource linked to for extra practice

Extra support was also provided in the glossary of computer skill vocabulary built into the Digital Homeroom and made available during this lesson, as featured in Figure 5.8.

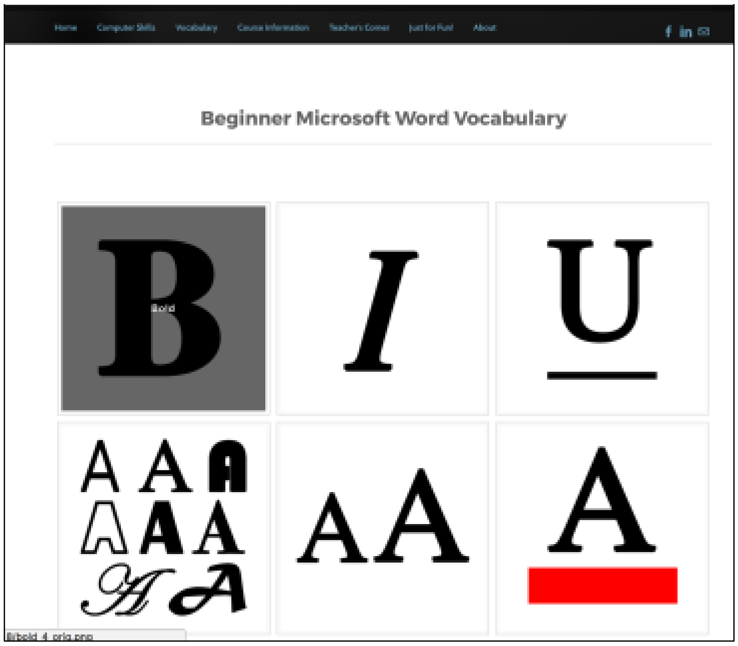


Figure 5.8. Glossary for Word formatting provided in Digital Homeroom

Erik also stated in a focus group discussion on June 24, 2016 that he had begun to rely on a website that introduced computer skills in both Somali and English language.

Erik [The website] is not very good digital literacy instruction. But what it does, it has Somali translation which means that it's a starting the point for people to do it that way. So, basically, they go and do the Somali and English translations. Build this confidence and sort of like trust themselves and then we can go into things that are all in English .... So even though I'm reluctant to use that because in terms of digital literacy instruction, it’s not great … it's like an establishment point and then from there we can move on to other

9 things… beginning in Somali doesn't overwhelm some of my students. So, for that case it's good right now until I can find a better alternative.

(Transcript from focus group, June 24, 2016. Starting at 12:00)

Erik's comments in this transcript suggest an understanding of the importance of his learners' understanding concept that would lead to English vocabulary knowledge.

One final data point, a third observation of the same class, showed continued growth in Erik's sensitivity to the learning needs of his students and their capacity to develop knowledge of vocabulary. Erik followed a very similar process in a third observation of the same class on March 13, 2017. He began his instruction by showing the glossary pictured above and then, in turn, introduced each of the focus skills and vocabulary (i.e., the words "bold," "italics," and "underline"). The words were presented and explained, then the learners wrote them on their handouts, finally, they typed them and formatted accordingly. Students created a Word document like the one pictured on Erik's screen and on the screen of the learner featured in figure 5.9. However, in contrast to the June 17, 2016 class, in this class he taught only these words and skills, instead of teaching other skills and terms too. Because he tried to teach less, there was ample time for support in between the introduction of new words and each learner had more time to draw on practice resources and individual help from Erik and the volunteer (who on this particular day was the author).

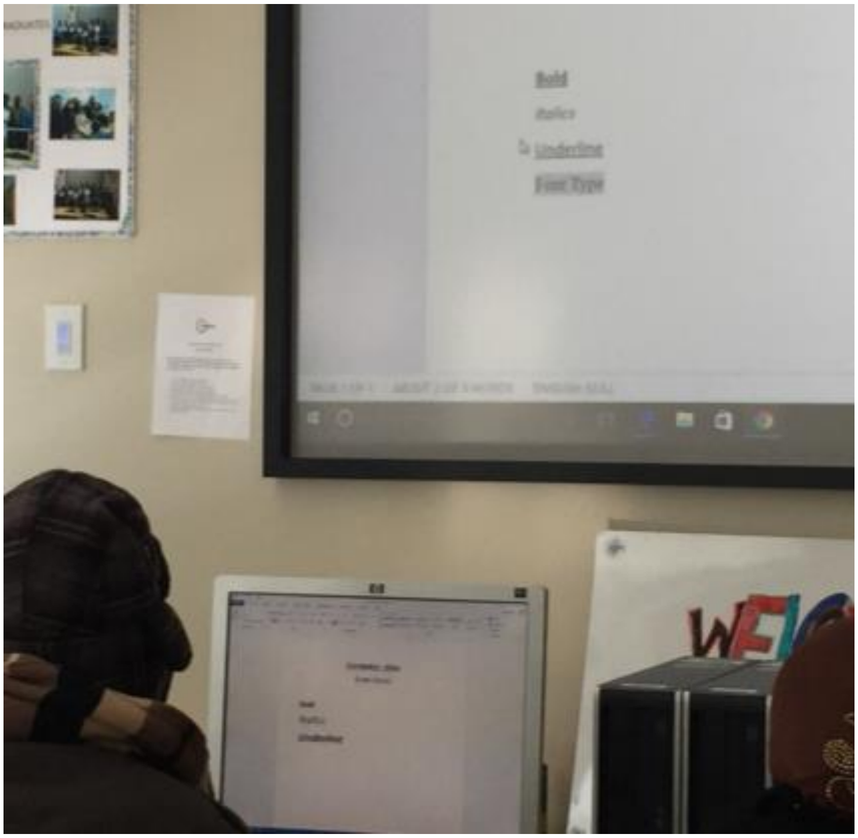


Figure 5.9. Formatted text in Word

In a conversation after class, Erik commented on his approach, *"Yeah, I need to break the Word one [lesson] into fonts and then into formatting and into [inaudible]. I've* done that *but not physically changing it [the handout]."*

Marty's work at Newcomer House. The shift to incorporating more explicit support for vocabulary building and time to learn and practice it was also evident in a March 15, 2017 class taught by Marty at Newcomer Home. The one hour class focusing on Computer Basics was almost entirely a vocabulary lesson about the parts of a computer. Marty led the class through six activities, five of which supported vocabulary development. These included: clever use of a document camera and small cards picturing the vocabulary words which were sorted into the categories “hardware” or “software” (see Figure 5.10) and then naming the parts visible on an actual laptop. She then had the learners pull up the computer basics page of online glossary (shown in Figure 5.10 above) and click through the words at leisure, which gave the students time to talk in their home languages (Spanish, Karen, and Somali) in small groups. Marty then pulled out an old laptop that had been taken apart and its constituent parts labeled, so that the learners could see a visible example of the interior hardware (see Figure 5.11).

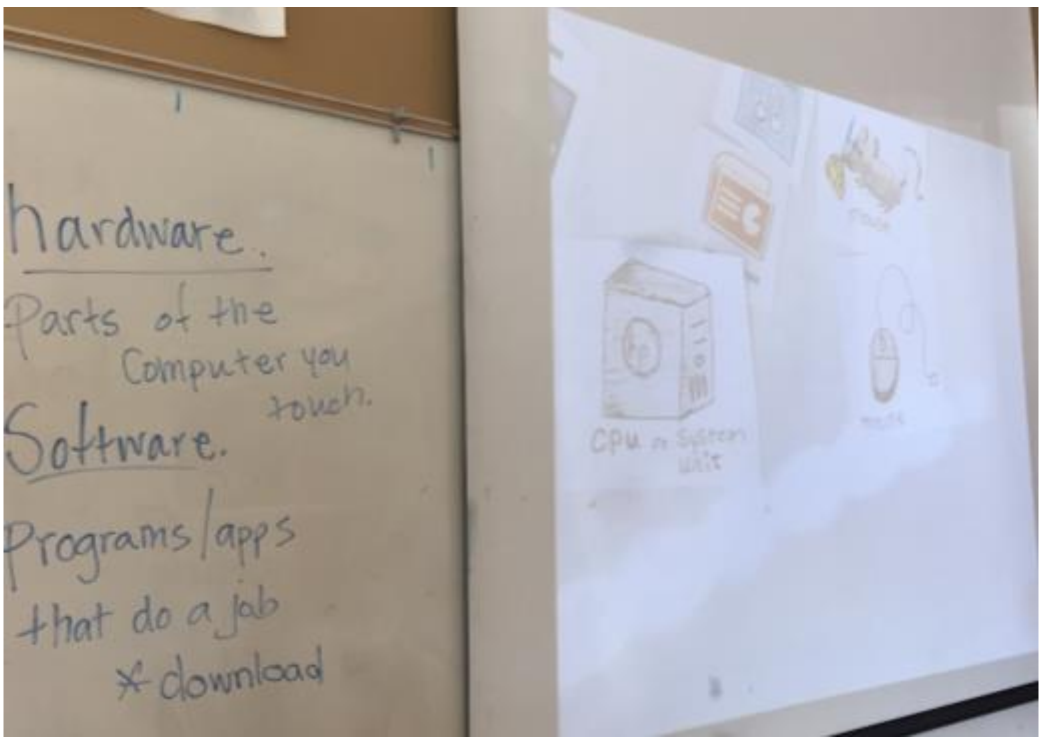


Figure 5.10. Document camera vocabulary activity

Figure 5.10 shows the setup for the activity written on the whiteboard, including definitions of the terms hardware and software, but words listed in the Northstar Digital

Literacy Assessment standards. The images projected on the screen are the sketches that Marty made of the different vocabulary words for the skills taught that day.

Figure 5.11. Labeled laptop

Figure 5.11 shows an additional vocabulary activity observed in the class. Marty had learners examine a disassembled laptop so they could see internal components that are listed in the Northstar standards. Marty ended the class with another classification activity using a worksheet, requiring the learners to write the word for the first time. She had learners come to a board to write their answers on a projected image of the worksheet (pictured in figure 5.12).

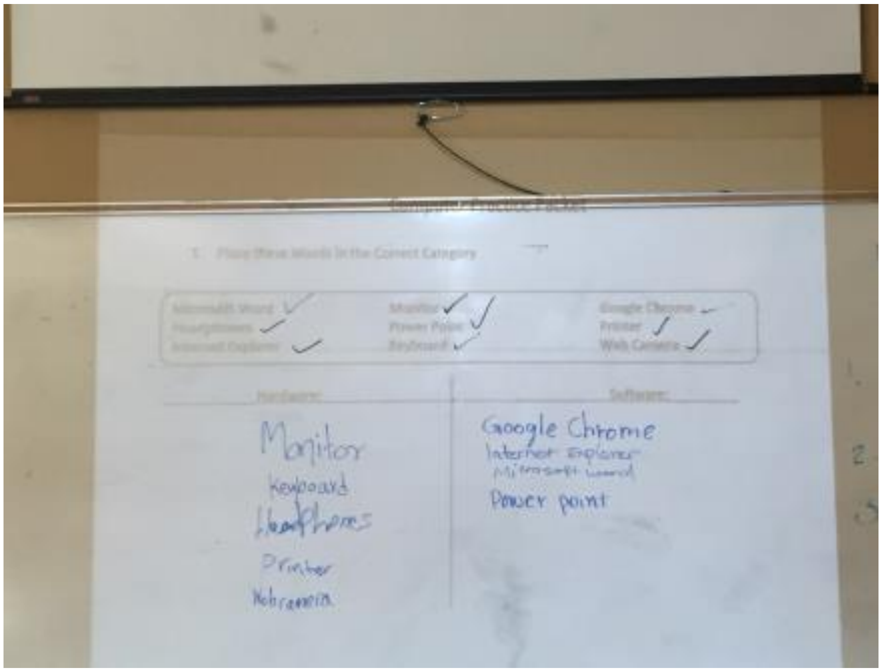


Figure 5.12 Projected vocabulary worksheet

Learners came up to the whiteboard and wrote one word in the correct column. After a word was written, the rest of the students confirmed or contested the choice.

In field notes documenting a debriefing conversation after class, Marty observed that, over the 17 months she had been at Newcomer Home, she had realized the importance of making time for ample vocabulary support. To make this possible, she said that she had slowed down the pace of the assessment cycle from three instructional hours before an assessment to 40 hours, with nearly half of those hours dedicated to vocabulary development and other language required to make use of computer.

Talking about their work. Data from focus group discussions support observational data provided above, showing that there were changes in the way corps members treated vocabulary in their instruction. The first excerpt is drawn from February

26, 2016 and the second from June 24, 2016. The first excerpt shows a conversation spurred by a request to contribute a scenario or interaction that that was memorable or somehow with hindsight represented interactions more globally with ELLs.

Erik So, I'll be trying to teach the difference between a normal cursor and when it turns to the hand to click a link and I'll be trying to illustrate, "Oh, look for when it turns into the hand." And they start thinking about literally my hand instead of thinking about the mouse. And I'll be saying it over and over and it will just get kind of confusing and they'll be like looking at my hand and not at the screen and then I'm like look for this [gesture - points to hand] on the screen. … It's a lot of translating from the literal to the digital and that's difficult. So I actually do an activity that is, so what they do is the students take a piece of paper, the students put their name on it, they put it into a physical folder, label the folder Minneapolis, put the folder into the filing cabinet, and then we go into the computer, open a document, type their name, save it, create a folder, put that into the folder and put the folder and it, I've only actually tried it once so far and it was kind of funny and I think people got what I was getting at, I don't know how effective it was in creating the translation, but I think it might be worth trying again because it didn't flop. People got what was going on. About halfway through people were like "Oh, ok I see what you're doing. Nice job."

John So, in other words, whatever you do real, do mag [cut off] [[do

Marty magically]].

John [[On the computer]], not magically but do it on the computer and do it physically and on the computer but make everything equal.

Erik Oh yeah. I think that’s what I meant. Label the folder Minneapolis on the computer as well as on the physical folder.

(Transcript from focus group, February 26, 2016. Starting at 6.53)

In this excerpt Erik provided two narrative descriptions that reflect his early thinking on how vocabulary and skill development work together to support learning in his classes. In the first, the description of the “hand” issue and in the second, the descriptions of a spontaneous instructional activity meant to teach “file” and “folder”, he identified the abstract nature of the skills and vocabulary he was trying to teach. In a transcript from a few months later, he provided a more theoretical explanation of this issue, which can be seen in the excerpt and the corresponding Figure 5.13. Key terms from his doodling that are mentioned in the transcript have been bolded for emphasis.

Erik So, I said **the literal are the words**, the actual words sometimes. **The physical is like a computer like this** [demonstrates something you can touch]. **The virtual is the presentation I make** on a web interface or on a PowerPoint **and then a conceptual is what they do**. And the literal to the physical and the literal to the virtual make complete sense people get that. They know how to name things very quickly. We learn that quickly and then I try to go to the conceptual, like from the word to the concept and that's the least connection, like that's where I'll lose people.

(Transcript from focus group, June 24 2016. Starting at 26.50)

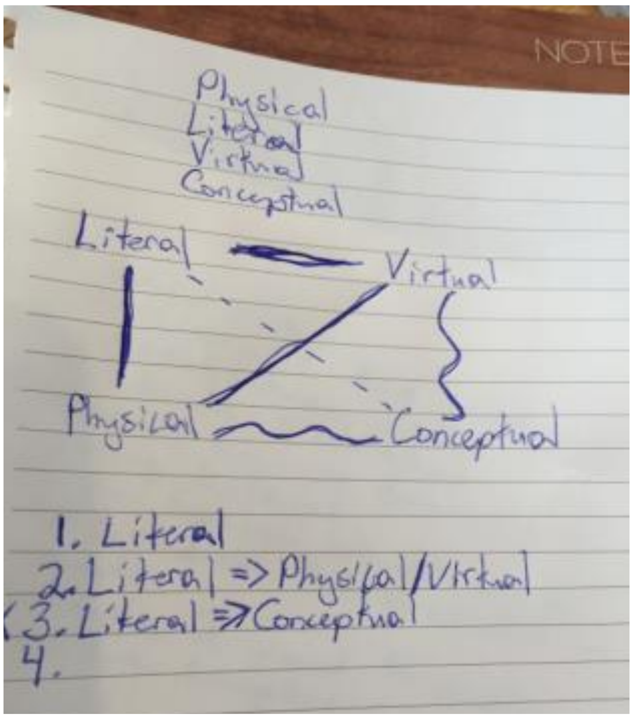


Figure 5.13. Erik’s understanding of the connection between skills and vocabulary

Erik’s description can be interpreted as follows. By the literal, he meant the vocabulary used to label the skills they were working on in class. The physical, was mostly just that, a physical object, but also referred to abstract representations of physical as required by the content, for example “hand cursor”, “file” or “folder”. Another example is the “bold” button visible on a computer screen, which cannot actually be touched; rather, it is an affordance that triggers a from the computer. Erik referred to his verbal and visual instruction as “the virtual” as in, something of the “physical” and “literal” that he had described. Finally, he suggested “the conceptual,” which was the learner’s demonstration of the focus skill. It is the goal of instruction. By providing this explanation, Erik showed that he has been thinking about the connection between skill mastery and vocabulary knowledge.

Further evidence of this reflection is evident in a later transcript excerpt of text that followed Erik’s presentation of his conceptual diagram shown in figure 5.13 above. The excerpt provides an example of Marty’s and Erik’s interpretation of what it means to know a word in the context of a computer skills class.

Jen [Clarifying question about concept map Erik drew] So, for example they might be able to succeed in a mousing activity but if you asked them to do something in a Word exercise they won't be able to do mousing?

Erik Yes.

Jen Or their inability to use [physical manipulate] with the mousing or the conceptual understanding in mousing gets in the way of actually being able to like make a word bold because they can't pick and drag to highlight?

Erik Yeah exactly and to me the conceptual means the ability to transfer that knowledge to other things. And that's how I define it at least … So basically, the X is where I kind of lose people. So, then after I noticed that words [his literal] to concept doesn't work, I'll try to go physical or virtual to concept, so then I try to show them this or say, “What does it do?” That still doesn't work. And so I'm, I think I've kind of hit a wall in my teaching, is the ability to get to the conceptual level.

Marty Oh, I totally identify with that.

Jen …So how do you know that they're not getting there…

Erik What is it that I noticed? When I introduce a new program they basically revert to where we were at the beginning, and people just saying, "I don’t get it like you show me." I'll very, very frequently teach on that.

Jen So you see them not being able to apply skills across contexts or learning to the tasks?

Erik Yes.

Marty Interesting

Erik It's like almost as if each [[new program everything]] [interrupted]…

Jen [interrupts]…[[required]] all new skills.

Erik Exactly. It's like mousing is not something you learn for all computer things it's something that mousing works for Microsoft word and my suggestion of this is from people saying show me things that they just showed me they did a second ago so.

(Transcript from focus group on June 26, 2016, minute 26:00)

The exchange reifies the finding that their thinking about the goal of their instruction had shifted to include a deeper understanding of what it means to know a word or skill. Both Erik and Marty provided further examples of this difficulty. Later in the transcript from June 26, 2016 Erik talked about learners mastering bold in Microsoft Word but then not recalling the concept when writing an email. Marty described how learners often accomplished a skill, like click and drag with a mouse, in Microsoft Word and then not recognize it on the Northstar Digital Literacy Assessment.

This level of reflection on the connection between language and skill was not evident in any earlier data. It signals a reflexive practice and the understanding that the goal of instruction is not simply memorizing a list of vocabulary words, or response to commands to replicate skills but a wish that learners can fully acquire both the language and skills to work independently.

Discussion and Implications

Although the functional approach to this research was illuminating, showing the source of the key terms of the "field" in basic computer skills classes and the inconsistency in the language employed to teach the skills, the findings point to a limitation in viewing the language of digital literacy from a strictly lexical perspective. These data suggest that vocabulary is just one aspect of conceptual understanding required for mastering the skills, which, together with knowledge of the abstract representation of a word within the hardware and software of the computer, also includes a broader conceptual knowledge and a physical embodiment of the skill instructed.

What is it to Know a Word? The Sociocultural Perspective

The notion of "concept" was introduced by the corps members several times in data presented above. They used the term as a practical description of the knowledge of a vocabulary and its associated skill in this context. Though they had not intended to, they hit upon a very useful theoretical construct in sociocultural theory. Vygotsky (1987) also used a Russian equivalent of the term; he equated "concept" as a way to frame a word's meaning, defining concept as a thematically unified entity that encompasses individual elements. He suggested that the meanings attributed to words are abstractions that gain meaning through observing its use and interaction (mediation) in a particular context. He understood that knowing a word's meaning reflects an understanding of the development of one's consciousness and an understanding of a concept. Vygotsky wrote that

> the development of concepts or word meanings presupposes the development of a whole series of functions. It presupposes the development of voluntary attention, logical memory, abstraction, comparison, and differentiation. (p. 166)

Knowledge of concepts develop over time, and involves both adoption of the cultural practices of a context in addition to developing systematic and categorical knowledge of words and their meanings. This process is mediated by activity in cultural practice. Vygotsky suggested that direct instruction of a particular skill or word is insufficient to support understanding of a concept; rather, a broader more abstracted knowledge of it is developed through ongoing mediated activity and observation. Further Vygotsky wrote,

> Direct instruction in concepts is impossible. It is pedagogically fruitless. The teacher who attempts to use this approach achieves nothing but a mindless learning of words, an empty verbalism that simulates or imitates

> the presence of concepts in the child. Under these conditions, the child learns not the concept but the word, and this word is taken over by the child through memory rather than thought. Such knowledge turns out to be inadequate in any meaningful application (Vygotsky, 1987, p. 166).

The development of conceptual knowledge, while supported by instruction, also requires lived experience to make the abstract more personal and comprehensible. Vygotsky noted that this required practice, activities necessary for the development of concepts. Practice is a social process because a person works toward development of cultural practice. It is mediated by use of tools and activities that focus attention on desired knowledge.

The data from this study showed that this theoretical interpretation of what it is to know a word or, rather, concept, is reflected in the efforts demonstrated by both Marty and Erik in the final months of the research process. Within what was possible at their respective sites, given learner demographics and the environment of the lab, each corps member, in some measure, arrived at the realization that simply knowing a word was not enough to support computer skill development. Consequently, each added instructional strategy expanded upon the direct instruction critiqued in the quote above to provide focus and mediated activities to offer a semblance of practice or lived experience necessary for the learners to not only understand the vocabulary and skills but also reach the conceptual level of understanding necessary for transferring those terms and skills into new contexts. Though community-technology labs offer different affordances for supporting learning (i.e., class duration or frequency, schedule, cohorts or drop-in), no matter the affordance, facilitators of learning in these environments would benefit from understanding that a conceptual knowledge is necessary if their goal is to teach transferrable skills.

In class, a teacher might lead students in an activity that requires matching words to associated concepts (e.g., grouping all text formatting words together) or simply asking questions about associations. Marty provided a useful example of this categorization in her activity requiring sorting cards with pictures of computer parts by asking, “Which words are hardware? Which words are software?” Indeed, Marty’s entire lesson from March 15, 2017 approaches what Graves et al. (2012) suggest is required:

> …lengthy and robust instruction that involves explicit teaching that includes both contextual and definitional information, multiple exposures to target words in varied contexts, and experiences that promote deep processing of words meanings is likely to be more powerful than less time-consuming and less robust instruction. (p. 23)

It is instruction that draws attention to meaning of specific words in context and allows for ample practice of decontextualized vocabulary.

The examples from Erik’s instruction certainly accomplished the former, but arguably his students would have benefited from more practice activities. The major difference instructional strategies represented for Erik and Marty is likely due to their contexts. Marty worked with the same learners a few hours each week for several weeks in a row, whereas Erik was never entirely sure who would attend for class, for how long each day or how many days in a row. In drop-in settings such as Erik’s, the role of vocabulary instruction in digital literacy might best be understood as a sort of triage to support understanding of the skill instruction provided in the L2 English. To ensure that instruction in such settings is suitable for the broadest range of students, it should be highly visual, supported by demonstration linking words to skills, and have ample opportunities to practice the key words followed by hands-on practice mediated by tutors or teachers. Ensuring opportunities for flexible mediation can best meet the individual differences in needs and learning challenges with vocabulary comprehension presented by a diverse group of learners (Ableeva, 2008).

Over the course of the research, Marty and Erik, the two corps members working with the low-level ELLs, developed a sophisticated understanding of what it means to know a word. This understanding developed over many months of observing learner reactions to their instruction, which is laid out in the data and findings presented above. Essentially, the participants grew to understand that coming to know a word in the context of digital literacy is a very complex process, which I suggest represents knowledge constituted by these components:

1) recognizing a word supplied in instruction, often the signifier of a skill being taught (the signified);
2) knowledge of how the signified is enacted or how to accomplish the skill;
3) the physical capacity to enact the skill, and
4) knowing when and why to enact the skill, or ability to recognize the vocabulary within and transfer to skill to a new context.

This list is not dissimilar from the process from Beck et al. (2013) articulated in the literature review section of this paper. On first consideration, point three, “The physical capacity to enact the skill" may seem beyond the scope of language instruction; however, I think it represents an extension or new application of our understanding of what it is to know a word. It adds an embodied use of the vocabulary, the requirement to physically enact the skill, which can complicate learning. For example, mousing requires both physical control of the mouse and spatial knowledge of where things are on the screen and how to move the mouse to direct the cursor. Physically enacting a computer skill is a component of the skill represented by the constituent lexicon of the "field", so to possess conceptual understanding that is transferrable, it can be argued that one must "do".

Theoretical Implications for SFL

Though Mohan and Leu (2005) wrote about the connection between SFL and computer assisted language learning (CALL), the authors focused on a functional approach as a framework for understanding the social practice of CALL, there is little research on the academic language required for development of nascent computer skills. This research therefore serves an example of research that pushes SFL in application to new contexts created by technological ubiquity of daily life in countries where migrants and refugees reside. This dissertation study illustrates this extended application of SFL by drawing on it to define key vocabulary. The extension in SFL as a theoretical framework here is my use of it as frame for conceptualizing the language development of learners who are both nascent computer users and early in their English language proficiency development. The social practice they are engaged in is not whole-text based, as is most commonly the unit of analysis of SFL, but internal or environmental cues for enacting a particular skill or use of a computer.

Schleppegrell (2004) writes:

> Students need to gain social experience with the ways of using language that are expected at school and a greater understanding of the linguistic resources available to construe new knowledge. A functional theory of language that links language and social context grounds the characterization of the task that students face at school in the challenges of realizing in language the new contexts and knowledge presented in the classrooms. (p.17)

In this context, meaning is embodied conceptual understanding of vocabulary, not a rote or behavioral response to a command. Meaning in this academic register requires an embodiment. If I say click and drag, it is not enough to understand what the words imply, one needs to be able to physically demonstrate knowledge of and then make use of the skill. In this case, perhaps language supports skill development in that it acts as cues to signal what a learner needs to practice, or can be used to ask for help with skill development. However, simply pre-teaching the vocabulary will likely not in itself support a learner's skill development. It is important that teachers attend to the meaning that is possible, and to leverage meaning when describing skills by providing more personalized explanations of how to carry out a task.

Conclusion

The corps member participants in this study did not have professional development to support the implications laid out above. Though they had access to a workshop on lesson planning at the beginning of their service and a library of resources accumulated by previous corps members, this was insufficient. Marty commented on this. *"I thought I wasn't a good teacher. I followed the websites she used and they just didn't work out. It was so frustrating"* (Focus group, August 16, 2016). The Digital Homeroom is one possible means to mitigate the challenge of providing sufficient vocabulary practice and individualized explanations to make both vocabulary and skills accessible to a range of learners. The glossary of terms and linked practice activities can provide a base on which TAC member can begin to build their own instructional strategies. Another possibility is training on the importance of ample opportunities to practice vocabulary and, perhaps, sharing the ideas described above about what it means to know a language in this context. The goal of any professional development should be to help TAC members understand what it means to know a word and embody it in completion of computer skills, and to know that they need to allow time for this to happen.

CHAPTER 6: IMPLICATIONS AND CONCLUSIONS

The goal of this dissertation was to engage in design research that both solved a local problem and extended knowledge on teaching and learning. The identified challenge was how to help Technology Access Collaborative (TAC) AmeriCorps members provide computer skills instruction that supported the broad and diverse student audiences present in their computer-technology labs. Because so many migrant adult learners in the United States work toward digital literacy by participating in such programming, out of the reach of formally trained teachers, the significance of this research has wide relevance. Together with my AmeriCorps participants, we achieved our goal: we defined the particular instructional challenges evident in their instructional settings and then collaboratively built and implemented the use of a web-based resource that accommodated many of the language and computer skill levels of the learners they taught through various semiotic means.

Summary of the Studies

This research, both the inquiry and the design process, were structured as three studies, each addressing significant aspects of the eventual designed resource:

1) the exploratory phase, consisting of a) a pilot study on learner identity and digital literacy which elucidated instructional challenges and b) a subsequent case study exploring the issue from the TAC members' perspectives;
2) a design study that led to the creation of an instructional resource, the Digital Homeroom (DiHo); and

3) a study exploring how the instructors employed key vocabulary in their computer skills instruction to adult migrants in community-technology labs.

Collectively, the three studies contribute to a deeper understanding of how DBR has utility as a methodology for producing both intervention resources and knowledge on teaching and learning in general. The findings, made possible by use of DBR, prompted unique extensions of the theoretical frameworks that guided the work. I will summarize the findings of each study and then turn to how, together, they inform practice and extend theoretical frameworks to provide new perspectives.

Study One: Defining Instructional Challenges through Analysis and Exploration

To begin the work, I needed to define the instructional challenge. The exploration and analysis phase, or needs analysis as conceptualized by McKinney and Reeves (2012), consisted of two parts: a pilot study where the issue first took shape, followed by a collaborative study to better understand the issue from the perspective of the instructors. DBR as a methodology requires that design be grounded in the experience of those directly impacted by an instructional challenge, so this two-part approach elucidated the needs of both learner and teacher. Through these studies, I first gained a better understanding of the learning ecology in community-technology labs and its impact on the learners by employing SLA identity theory. Second, I was able to confirm that the challenges I had observed as complicating learning in the pilot were indeed noted as instructional challenges that frustrated the teaching experience of the TACs.

What I found in the needs analysis was that TAC members over-employed teacher-centered large-group instruction. This instructional choice alienated all but the few learners whose pace and proficiency aligned with the instruction provided. The tightly controlled teacher-centered instruction negatively impacted the persistence of others. To mitigate the problematic aspects of this approach, and to compensate for lack of previous training, the needs analysis confirmed the need for a website to support differentiated instruction and expand learning beyond the classroom. This website came to be known by the participants as the digital homeroom, or DiHo.

Though my goal for this part of the study was practical (i.e., to document instructional needs), the chapter also contributed to my understanding of how the work fit into my overarching theoretical framework, Activity Theory. The needs analysis showed that, at least for this group of participants, focusing on the “mediating artifacts” pinnacle of the Activity System model could mitigate the impact of other constraints in the Activity System. Enhancing the mediating artifacts might result in instructional strategies better suited to support English language learners (ELLs) in the community-technology labs. The reformed mediating artifacts and instructional strategies would support an equitable distribution amongst the components of the Three Elements Triad (Silver-Pacuilla and Reder, 2008): the learner skills, the demands of the task, and the support provided. There was a demonstrated need for resources to scaffold the instruction provided, and those resources should be developed and employed with the goal of moving away from teacher-centered instructional strategies, which would simultaneously boost the support provided and lower the demands of the task for learners with very low skill levels.

Study Two: Design and Construction of an Instructional Resource

After the needs analysis, I moved into the design and construction phase of the work. Of course, the ultimate goal was to address the local challenge and design the DiHo. However, I also had two theoretical goals: The first goal was to elucidate which characteristics of the website best supported instruction. The second goal was to determine which learner needs became most salient for the TACs as they created and implemented the strategies and resources for digital literacy instruction.

Through the design and construction phase, which stretched several months and produced multiple iterations of the DiHo, my findings became clear. First, I saw that teachers needed access to ample resources that afforded opportunities for learner choice and supported differentiation; there needed to be something suitable for most any learner who came into the labs. Second, the actual structure of the website and the time put into developing it created a trust in its utility. It meant that the TACs could turn over control previously manifested in teacher-centered, large-group instruction. Throughout the research, I saw that both providing structure without ample resources and employing a number of resources without a pedagogical structure fell short. Either structure or resources alone failed to take the TACs out of their teacher-centered mode.

The website layout, characteristics, and elements shaped the DiHo into a pedagogical structure. This structure made it possible for users without any previous computer experience to use it independently; it needed to be easy to get to, have low print literacy requirements, and attend to elements of Universal Design (clear design, large graphics and font, obvious navigational affordances, and multiple modes of learning). Additionally, over the course of designing the DiHo, the TAC members came to understand that they needed to provide explicit vocabulary instruction that aligned with each of the computer skills sections, rather than having a comprehensive glossary. They also learned to include ample practice to ensure knowledge of key vocabulary. Without such alignment, the pedagogical structure of the DiHo was not transparent enough for tutors who came in to assist, or for learners working independently. Finally, the resources linked from the website needed to be relevant and easy to use.

As explained in Chapter 4, the design conjecture retrospectively crafted from the study was that if teachers have access to a digital homeroom stocked with relevant learning activities and ample vocabulary support, the teachers rely on the structure afforded by it to provide the control they perceive as required in their workshops. Further, the theoretical conjecture that followed stated that if teachers rely on the structure afforded by a digital homeroom to provide the control they perceive as required in their workshops, they observe learner engagement, which serves as motivation to further explore and respond to learner needs and create opportunities for differentiated instruction. These conjectures together suggest the importance of the DBR process in not only generating these theories but also creating learning opportunities for the TAC members. It was through the design process that they were able to grow as teachers. The task of design and construction gave them a lens through which to monitor and respond to learner needs. Further, the concrete task of construction was empowering. The data showed that rather than sticking to instructional strategies that frustrated both them and the learners, they committed to the design and construction, growing more aware of learner needs as they tested iterations of the DiHo. These findings represent additions to knowledge about teaching and learning and serve as a humble theory that might be tested in subsequent DBR phases.

Study Three: Academic Language of Computer Basics Classes

This inquiry was actually present throughout the entire project; I included it to better understand the impact of English as the language of instruction in a context where the TAC members worked with multilingual learners who possessed low English language proficiency. I first sought to articulate the particular lexical structures (i.e., vocabulary) evident in classroom discourse of digital literacy and then to see how the TAC members drew on it in their instruction.

I documented growth in this aspect of the TAC member teaching, too. At the beginning of the research, their instruction showed little attention to the language required for participation in learning opportunities in their workshops and labs. This was characterized in the early days by instruction laden with cursorily embedded definitions and display questions, followed by some explicit instruction but without adequate repetitions of exposure or practice to lead to transferrable knowledge for most learners. Toward the end of the project, TAC members seemed to grow into the idea that explicit vocabulary instruction, paired with adequate opportunities to practice, was needed for learners to truly understand a word and its associated skill. This, they suggested, was evident when a learner could recognize the name of a skill in digital environments outside of the one in which they first learned it (e.g., knowing how to "bold" a word in an email message after having initially practiced it in Word, or knowing that this action could be accomplished through use of either 'mousing' or keyboard commands, and physically demonstrating the skill).

This interpretation of knowing a word is arguably an extension of research in ESL vocabulary. Here, knowing a word requires an understanding of the physical embodiment of the skills associated with it. Specifically, it means: knowing the key vocabulary describing a skill, recognizing the vocabulary and skill in multiple contexts, and being able to physically employ it in multiple contexts. I suggest that this is embodying the skill, and that for the purposes of successful participation in computer skills classes, deep knowledge of the vocabulary and an embodiment of the skill are needed. For this to happen, teachers needed to provide explicit introduction, multiple exposures, and ample opportunities to practice.

Discussion and Implications

The studies, their findings, and the development of knowledge in several areas described above are a springboard for reflection on the impact of the study as a whole. These findings suggest that the goals of developing a resource and extending guiding theoretical frameworks were both achieved. The TAC members designed an instructional resource to support them in their work based on that work I argue that a.) focusing on tools or artifacts of an activity system can support the equitable distribution amongst the three pillars of Silver-Pacuilla and Reder's (2008) Required Elements Triad (i.e., learner skill, support available, and the demands of the task at hand); b.) designing and constructing the DiHo resource contributed to TAC members' professional growth and boosted their confidence in their practice; and c.) knowing a word and possessing a skill in this context go hand in hand, and their mastery is demonstrated as an embodiment of both. The work has broader significance and implications beyond this knowledge. Namely, my DBR research has resulted in an educative curriculum, the development of which suggests a shift in Engeström's Activity System model, and finally, these observations suggest a positive impact of, and even an imperative for, engaged researchers working in collaboration with educators in naturalistic settings.

Design as Educative Process: Creating an Educative Curriculum

As suggested above, the construction of the DiHo using the structure required by the DBR process (i.e., the EDR cycles of design articulated by McKinney & Reeves, (2012) was itself educative for the TAC members; further, I argue that this work resulted in an educative curriculum. Davis and Krajcik (2005) defined this as curriculum materials that promote teacher learning while they are employed for student learning. The affordances of such materials can impact teacher pedagogical content knowledge, defined by Shulman (1987) as knowledge of how to teach particular content. Such knowledge involves an understanding of not only the content but also how it is best presented to students.

The design of curriculum materials can signal their intended use or constraints for instruction. Brown (2009, citing Burke 1966) suggests that constraining properties of an artifact need not always be considered limitations; rather, they might be considered boundaries to help shape constructive use of the tool. They make it possible for teachers to do things they otherwise might not consider doing or be able to do on their own.

In this light, teaching is design; teachers reflexively modify and integrate materials in order to reach instructional goals. Truly educative curriculum materials promote a teacher's pedagogical design capacity (PDC), defined by Brown (2009) as "a teacher's skill in perceiving affordances, making decisions, and following through on plans … PDC describes the manner and degree to which teachers create deliberate, productive designs that help accomplish their instructional goals" (p. 29). PDC is the capacity of teachers to rely on current knowledge and other resources to adapt curriculum to meet the specific learning needs of the context. Starting with an educative curriculum can help teachers add new ideas to their practice, support or illustrate social norms for teaching, and provide "enculturation into teacher discourse and practice" (Davis & Krajcik, 2005, p. 7). In the case of future TAC members using the DiHo, decisions made will likely include when and how to use it and how to customize it to meet the needs of their students.

In his 2002 study of teacher choices evident in the implementation of a middle school math curriculum, Brown (2009) maintains that teachers use curricula in three ways: offloading, adapting, or improvising materials. I argue that giving the TAC members a digital homeroom, or DiHo, provided scaffolding for them to start making decisions about how to provide learner-centered instruction. Further, I suggest that future TAC members will have a more advanced starting point in their work. This was determined by examining the Design Capacity for Enactment (DCE) Framework articulated in Brown (2009), which maps different components of teacher-tool relationship, representing a dialogic view that teachers are in conversation with their texts, resources, and curriculum as they make choices, adopt, adapt, or abandon them. These choices are based on teacher “knowledge, skill, goals, and beliefs” manifested in their perception of curricular options and balanced against a range of “design features and embedded knowledge that compromise curriculum materials” (p. 26). Brown’s work is useful because it hints at how my TAC participants had nothing on which to “offload” before they created the DiHo, which limited their perceived range of options, and perhaps explained why they stuck to teacher-centered instructional strategies even though they said it was frustrating and exhausting.

Through development of the DiHo, the TAC members strengthened their pedagogical design capacity, which helped them mobilize resources in new and constructive ways. This required “skill in perceiving the affordances of materials and making decisions about how to use them to craft instructional episodes that achieve her

[sic] goals" (Brown, 2009, p. 28). The DiHo, both in the design phase and in eventual use, gave them knowledge about how to teach, in addition to knowledge about what to teach. By strengthening their PDC, they were better able to enact the activities they had designed or selected, and landed on pedagogy that was more beneficial for the learners. Brown suggested that teachers with developed PDC can deconstruct and reassemble instructional resources in order to design pedagogically beneficial materials and activities. Teachers with low PDC cannot do that and require scaffolding and support with their instruction if they are to meet their instructional goals. Moving forward, it would be useful to observe with a new group how having the DiHo to react to will position them differently, whether or not the DiHo is an educative curriculum, and whether the embedded knowledge in DiHo will coax them away from or mitigate entirely the perceived need to provide teacher-centered instruction.

Ball & Cohen (2016) describe how educative materials and curriculum, like standards-based scripted curricula, can support teacher learning. First, they help teachers consider ways to relate units during the year, thus creating opportunities for transfer of skills and knowledge from one content area to the next (e.g., showing that *bold* works the same way in Word as it does in email text formatting affordances). Second, curriculum materials support teachers' learning of subject matter, but more importantly, they help teachers learn how to anticipate and interpret how learners might respond to instruction of a particular skill-development activity. Making use of educative curricula can be incredibly useful in contexts like my participant sites, because ongoing professional development is not generally available there to the extent that it might be required.

Though the process of creating DiHo was educative for the current TAC members, its value as educative curriculum will be indicated as the next program year gets underway and new TAC members enter the field. The decisions made by this year's members will provide a model for next year's group because, as Ball and Cohen (1996) suggest, educative curriculum materials shed light on the developers' pedagogical judgments, hinting at the ideas underlying the materials, and, consequently, help teachers make decisions about how to adapt or make use of them.

This suggests that curriculum materials can be viewed as a way to influence classroom instruction, a point that has been criticized as minimizing professional capacity of the teachers and limiting choice (Ball & Cohen, 1996). However, teachers can rely on an educative curriculum without adhering to it as the sole guide for their instruction. This is curriculum enactment, a curriculum crafted jointly by teachers, students, and developed materials in a classroom context. Ball and Cohen suggest that creating curricula structured to support sound enactment should be the goal of designers in order to help teachers to "be more rather than less informed, and to become more thoughtful professionals with more choices" (p. 8). In an enactment view of curriculum use, the TAC members can lean on the DiHo for guidance, but might also bring in additional resources or add personal small-group instruction when needed.

This is *use* of curriculum rather than *implementation* of curriculum. Lloyd, Remillard, and Herbel-Eisenmann (2009) indicated that the word “implement” is insufficient for describing teacher use of resources because it assumes that any curriculum was embedded with everything the teacher needs to enact it. In reality, teaching requires a variety of interrelated pedagogical activities. I want teachers to use the site, not merely implement it, because *use* suggests agency on the part of TAC members, and acknowledges that their practice will grow over their program year. Consequently, the way they teach and structure the materials or customize the DiHo will also change.

The DiHo is educative because it represents foundational knowledge about pedagogical needs in the specific context in which it was designed; it is, therefore, an embodiment of the learning experienced by the TAC members who designed it. Brown (2009) wrote that curricular resources are artifacts of design that embody the ideas of the designer and can engage practitioners with innovative ideas and thus support teacher change in practice. This is artifact as mediating influence, as conceptualized more broadly by Vygotsky (1978) emphasizing an interconnectedness between tool and agent (e.g., DiHo and TAC member). The affordances and constraints of the artifacts employed in this work defined the range of possibilities available to the TAC members. In this case, the tools or artifacts not only are important mediators of student learning but also serve as affordances that mediate teacher development.

Impact of DBR on an Activity System

The teacher learning that occurred during my study can be viewed more broadly as a change in the ecology of the classroom. The change was prompted by a new resource on which, in Brown's terms, teachers can "offload" pedagogical tasks (2009, p. 23). This shift can be mapped onto a new, albeit subtly, conceptualization of the Activity System model created by Engeström (1987) to represent Activity Theory at work. Engeström's foundation for the activity system was Vygotsky's model of mediated action, pictured below as Figure 6.1.

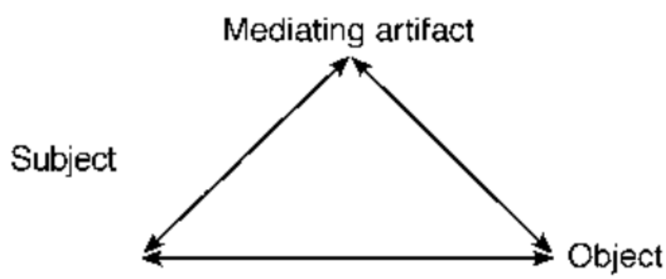


Figure 6.1. Vygotsky's model of mediated action (Figure 1 from Vygotsky, 1978, p. 40)

This model clearly shows that mediating artifacts have impact on both the subject and the object (in this case the TAC member and the learners). Similarly, the arrow connecting tools and sign to subject in the Activity System model below shows a similarly clearly expressed relationship

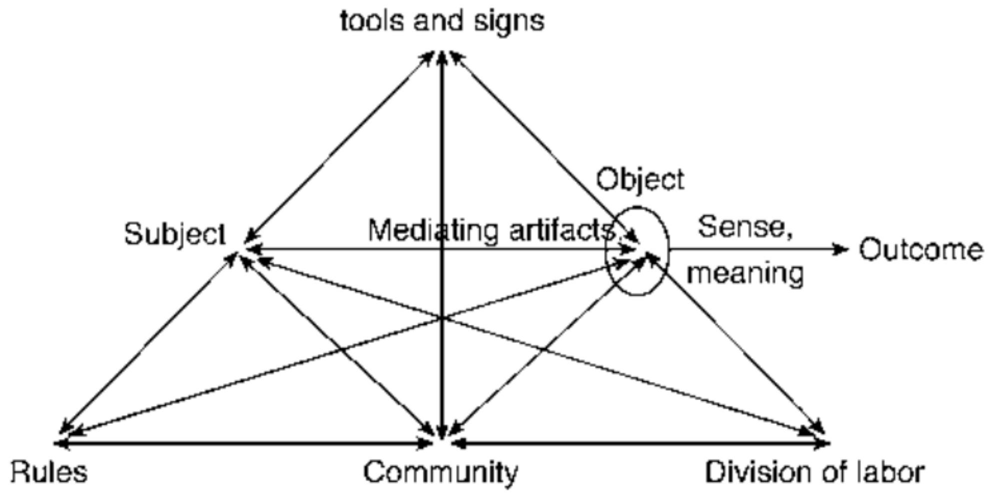


Figure 6.2 Engeström's activity system (from Engeström, 1987, p. 78)

However, though clearly represented in the model, this connection is not the focus of explanatory works that describe the relevance of the model. Engeström (1987) wrote that the model depicted how components of a system worked toward "object-oriented actions" (p. 134). Jonassen and Rohrer-Murphy (1999), in their useful analysis of the utility of Activity Theory as the basis for design of constructivist learning environments, wrote that in the model the subject acts on the object. Drawing on Nardi (1996) literature review comparing Activity Theory to situated learning, they suggested that the object was the changeable aspect of the Activity System. Nardi (1996) asserted that the object was transformed in the course of activity in the model.

This is an interpretation of the Activity System that is reflected in much of the literature. However, it is incomplete because it downplays the impact of the mediating tools on the subject itself, and suggests that the subject is immutable. Because TAC member instructional growth was an important outcome of my research, I think a shift in interpretation of the model, one that heightens the impact of this relationship, is important for interpreting my study. The growth of the TAC members suggests the importance of the bidirectional impact of the mediating tools in the model in a way that reflects the impact not only on the intended object, but also on the subject. Here, the design process required by DBR led to a focus on the upper pinnacle of the activity system and, as illustrated by TAC member movement away from teacher-centered and toward differentiated instruction because of their use of DiHo, the designed tool had an impact on the subject, actually changing the role of TAC members to that of both subject and object. McKinney and Reeves (2013) suggest such change is common in DBR, that a by-product of DBR is often professional development for everyone involved.

Engaged Research

This view, that DBR serves as professional development, sheds new light on early criticisms of DBR regarding the Hawthorne effect, the observed tendency of the presence of researchers to produce a desired effect simply because there is attention focused on the subject's well-being or learning. My research in this context shows that there was likely a Hawthorne effect due to my presence and the use of DBR, but it does not follow that that this effect was deleterious or makes the research less valuable. The finding that, through the process of design, the TAC members became more likely to employ differentiated instruction suggests that the effect was more effective pedagogical practice. Though the TAC members might have undertaken the task of working together without my support, they likely would not have employed such a structured design process and, it follows, may not have developed an awareness of the impact of their design on their learners. Therefore, my role as a coach, facilitator, and organizer directly contributed to changes they made in the classroom. I should state clearly that I was not directive. My role was to observe and respond to what I saw and heard with references to literature or exemplar design.

In this particular case, my role might be viewed by Lave and Wenger (1991) as part of the core of a community of practice (CoP). Full participation in a CoP, at one end of the spectrum, is illustrated by one's ability to participate as a "master." Peripheral participation represents a lesser degree to which one can participate in the tasks of a community. The TAC members were peripheral participants connected to a larger CoP of educators and scholars working to understand how to provide digital literacy instruction. They were connected to this CoP through me, who, given my nearly 20 years of experience in the field, was likely perceived by them as a "master."

Lave and Wenger (1991) viewed participation in social practice is "the fundamental form of learning" (p. 54). For the TAC members, the process of developing the DiHo was their social practice and means by which they learned about teaching. Through this work, their view of what it meant to teach in this context, that is, their identity as teachers, shifted. Lave and Wenger suggest that learning and identity are inseparable constructs. Learning means becoming a different person, one more fully equipped to participate in activities or possess understanding within the situated environment or social community. The TAC members grew into being facilitators of learning, which is the most effective role in such instructional settings, and with their commitment to producing materials to help future TAC members, appeared to be moving toward "master" status, spreading learning to new peripheral participants.

My role here was to be supportive, which aligns with what Lave and Wenger suggest is called for in a CoP. They wrote, "The master's effectiveness at producing learning … depends on her ability to manage effectively a division of participation that provides for growth of the student" (p. 21). I took this division of participation seriously, providing support when asked and resisting intervening when it would have only served my needs, for example at times when I wanted to push the timeline of the DiHo development to better suit my research timeline. At a time when questioning of the effectiveness and public good of educational research is common, I think my work serves as an example of engaged research that places researchers ethically in the communities they need to study, not just to intervene and observe.

Limitations of the Study

Cobb, Confrey, DiSessa, Lehrer and Schauble (2003) suggested that theories developed in DBR are not grand theories but humble theories, "not merely in the sense that they are concerned with domain-specific learning processes, but also because they are accountable to the activity of design" (p. 10). They are theories that do real work. So, how useful is the theory generated here? It is humble, most certainly, but is it relevant outside of the setting that generated it? To answer this, I think more research is needed.

Indeed, DBR is often longitudinal, stretching over several years, taking the time and resources to employ a research team that iteratively designs and tests a resource in multiple settings, continuously refining both theory and design along the way. This is very practical theory building; however, the practicality of the work is perhaps its greatest limitation. Incremental theoretical gains are possible but ontological shifts are not; and, in a time of rapid technological change, we need grand theories to guide use of ever changing options.

Further, replication of this study would be a challenge for another researcher. I was working with participants willing to invest time in developing instructional resources and who shared the need to account for and theorize the changes that occurred in resource design. There is seldom time for such work in a teacher's day. We had amazing synergy as a group because the TAC members had been given time to solve this problem and were committed to doing so, not only for themselves but to contribute to knowledge on teaching and learning. Similarly, I came to this research with nearly two decades of practitioner and teacher educator experience. My passion for starting my doctoral work was to solve this problem. I think I was the right researcher, in the right place, at the right time and with the perfect collaborators. The rigor of this study, therefore, had more impact on validity of findings but did not necessarily support replicability.

Walker (2011) observed that though DBR is intended to support a cycle of instructional improvement leading to theorizing, and theorizing leading to instructional improvement, this has not been completely borne out in the decades that DBR has been in development. Therefore, Walker suggested that DBR was still in the process of adequately developing methodology where contextualized interventions can inform broader theory. Further, Walker suggested that problems generating theory might represent a deeper epistemological issue. He questioned the efficacy of looking to design research in engineering as a model for educational design research because the goal of DBR is to "improve the learning of human beings" rather than improving things like computers, software, and airplanes (p. 55).

Finally, it should be noted that there are limitations associated with my final theoretical conjecture, *"If TAC members rely on the structure afforded by the DiHo to provide the control they perceive as required in their workshops, they can observe learner engagement, which serves as motivation to further explore and respond to learner needs and create opportunities for differentiated instruction."* I suggested previously that this conjecture could serve as a springboard for future study of the DiHo. This is certainly true, but it should be noted that use of the website alone is not likely to result in successful instruction if it is not paired with some professional development to support its use. Professional develop an important component of successfully teaching with technology; however, because this research looked to the impact of resource design on growth of teacher knowledge, it was out of scope of the study.

Despite this, I think DBR has tremendous potential to contribute to the body(ies) of knowledge that guide education policy and practice. Its primary strength is that it is use-inspired research linked to both theory and practice. It grounds interventions in prior research, and its resulting theories are grounded in real-world context. Because practitioners are critical partners in all aspects of the research, any decision made is likely to be more practical and better able to contribute to relevant and robust findings. Most importantly, this research approach requires a commitment on the part of researchers to engage deeply in naturalistic setting and work to solve a problem, rather than merely introducing an intervention and testing its effectiveness. Because the local solution is highly valued, this is an ethical means by which to construct theory. The researcher positionality required by this approach is that of partner, facilitator, expert, designer, researcher, and learner.

Future Work

I see two areas of future work that would extend knowledge about supporting migrant adults in computer labs. First is a return to a learner-focused study. This work began with an exploration of learner experience through a poststructuralist lens. Now, having shifted to a sociocultural framework to explore how the TAC members' instruction was mitigated by artifacts and environment, I would like to return to explore use of it from the learner's point of view. At this point, I only know about learner perceptions of DiHo through indirect means, observing them using it. I propose returning to a poststructuralist lens to explore learner identity and investment in classes that use the current version of DiHo.

Another approach to extending the knowledge developed by this current study would be to scale up by repeating the EDR cycle that served as the structure of this dissertation, adding a second meso-cycle. I would seek new corps members serving in the TAC program to see if use of the DiHo from the beginning of their program year had any impact on their instructional strategies. A focus of this inquiry would be to explore the extent to which outcome identified in the conjecture map in Chapter 4 is present. The outcome suggested that use of the DiHo made it possible for TAC members to observe and respond to learner engagement, freeing them from the perceived need for tightly teacher-controlled instruction.

An extended topic of inquiry for an added meso-cycle might be the larger context of the AmeriCorps program, or the CBOs that host the corps members. Zooming out in this way might elucidate larger institutional issues that impact the choices made by TAC member in their computer labs. Such a study would likely require addressing these issues via the design of the DiHo, thereby supporting the sustainability of the DiHo after the study.

What happens in the research setting after the project ends should be of great concern to education researchers. Often, when a study ends, so too does use of the resource (Barab & Squire, 2004). To mitigate this eventuality, Fishman, et al. (2013) suggested an approach called Design Based Implementation Research (DBIR), which involves developing capacity not only of teachers but of entire systems in order to support sustainability of intervention. Their approach is informed by several existing lines of inquiry: evaluation, community based participatory research, DBR, implementation research, and social design experiments. In this approach, the engagement of multiple stakeholders' perspectives is included from the start.

The object of design is different too; DBR focuses on design of an environment for learning and/or PD for teachers. DBIR includes this, plus explores what is required for support of the implementation at the administrative level. This means that iterative design includes defining changes in implementation required to support new iterations of design, and resulting theories developed through iterative design are about *both* learning and implementation. This innovation takes Brown's extension of educational research from lab to classroom and stretches it further to include an entire system. As such, results from DBIR have the potential to impact policy on the professional development of teachers.

Conclusion

DBR is a big undertaking, one often engaged in by a team of researchers, not one graduate student. Despite this, I think that, together with my participant corps members, we accomplished the dual goals of developing a useful tool and extending guiding theoretical frameworks. Specifically, we designed an instructional resource that made possible equitable distribution amongst the three pillars of Silver-Pacuilla and Reder's (2008) Required Elements Triad (learner skill, support available, and demands of the task). The opportunity to engage in this work supported TAC members' professional growth and boosted their confidence in their instruction, particularly their understanding and work in developing learners' English language proficiency as needed to support computer skill development.

These local gains, which go far in mitigating the instructional challenges identified by the TAC members, also indicate the broader significance and implications of the research. Most importantly, the professional growth identified in the study points to the importance of the relationship between subject and the tools, or artifacts, of an Activity System, and how neither is immutable in a DBR project. The also study shows how using EDR as the structure for developing an intervention resulted in an educative curriculum, which will be useful for future corps members.

A final implication about DBR resonates with me as I conclude this chapter; conducting academic research creates a tension between not necessarily conflicting but somewhat dissonant needs: satisfying expectations for theoretical gain that is interesting or publishable balanced against managing the deluge of data common in DBR research. In this case, the deluge was caused in part by my commitment to serve the partnering AmeriCorps program by working to develop a resource that would be useful across the different settings where their corps members offer computer classes. This required involving multiple CBOs in order to represent the range of sites in the AmeriCorps program. The scope of this work would have been better managed by a team of researchers and better reported in a series of manuscripts.

Reflecting back on the work, I believe it was worth the effort, and I am reminded of why I engaged in this research the way I did. Adult Basic Education programs in the United States cannot keep up with the demand of services, especially in provision of opportunities for the most vulnerable groups, individuals with limited English and low levels of education in their home countries. Formal ABE program serve only 1.5 million of the 93 million who have basic skill and literacy needs and waiting lists for programming exist in every state (*Adult education services: the success, the impact and the need*, 2016). This is particularly concerning for the lowest level English language learners who are often newly arrived refugees who often need immediate access and need to participate for a longer period of time before they can achieve even intermediate levels of proficiency. That means that CBOs like the sites described in this research do much to fill the gap. Newcomers rely on the services these CBOs provide; what they learn there helps support their linguistic, economic, and civic integration. Any engaged researcher working within these programs needs to endeavor to build practical, generalizable knowledge to support the instruction learners encounter therein.

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Appendix A: Pilot Study Interview Protocol

1. Why do you want to improve your computer skills?
2. Have you been in a situation where you wished your computer skills were better? Applying for a job? Filling out online forms? Doing schoolwork?
3. Why did you choose this agency/program?
4. What have you learned from the online activities?
5. What have you learned from the workshops?
6. What special things have the teachers done to help you understand the lessons?
7. Tell me about a time when you felt very frustrated in this program?
8. Tell me about a time when you felt very successful.
9. What are your future plans for more learning? Enroll in ABE? Take more computer workshops? Do independent online learning?
10. What has gotten in the way of your computer lessons/goals/workshops?
11. What has prevented you from gaining the computer skills you need?

Appendix B: Transcription Conventions

.	Fall intonation
?	Rising intonation
!	Intensified volume
…	trailing off in volume
,	pause, continuing intonation
ALL CAPS	emphasis
[brackets]	Transcriber/researcher comments
[[double]]	Overlapping talk
(…)	Ellipsis

Appendix C: Study 1 Focus Group Questions

February 26, 2016

1. Think back to your months of teaching. Tell us a story about an exchange you had with and ELL that was memorable, challenging, and perhaps representative of your larger work.
2. How, generally, would you characterize the challenges you have with ELLs: include mention of materials, language, differentiation, choosing activities.
3. What has stuck with you most from the reading that you've done?
4. What has stuck with most from visits to each other's classrooms?
5. If there were one thing we could do to make it easier for you to support ELLs what would it be?

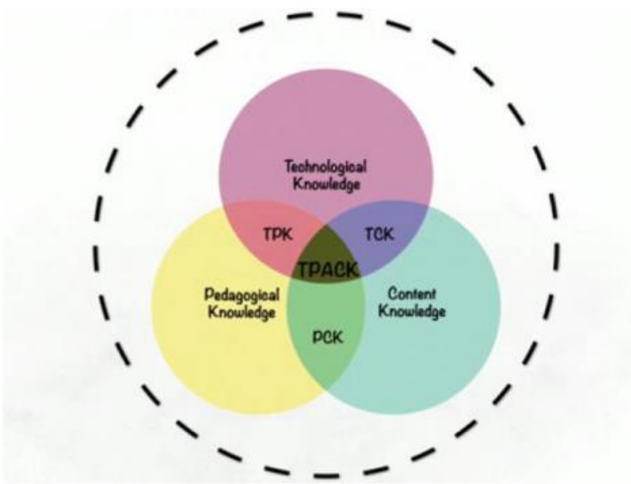
Questions for March 01, 2016

Impromptu focus group. No students showed up for a scheduled class, so there were no prepared questions.

March 18, 2016

1. What is your favorite thing about the work that you're doing right now?
2. What is one thing you've done to make your students feel like they belong in the classroom/lab?
3. What has stuck with most from visits to each other's classrooms?
4. As you watch the video, take notes about your areas of confidence and areas you

wish to enhance? Reflect or note about how our imagined intervention might support your work.



Screenshot of TPACK model video. https://www.commonsensemedia.org/videos/introduction-to-the-tpack-model#

5. Where on the TPACK model do your strengths and weaknesses lie?
6. On which part of the model should our intervention focus?
7. If there were one thing we could do to make it easier for you to support ELLs what would it be?

April 14, 2016

1. What's on your mind?
2. Let's talk about our design. Who or which learners are you designing for?
3. What are you designing? Think about it in terms of the areas of TPACK.
   Technology – How will what you build support your use of technology in your teaching?

Pedagogy - How will what you build support your pedagogical choices/ instructional strategies?

Content – What content (of instruction) will be included in your design or will your design support?

Questions planned, but not addressed:

4. Also, how will what we design address usability/utility? What do you think of when you see this model from Kirschner et al. (2004)?

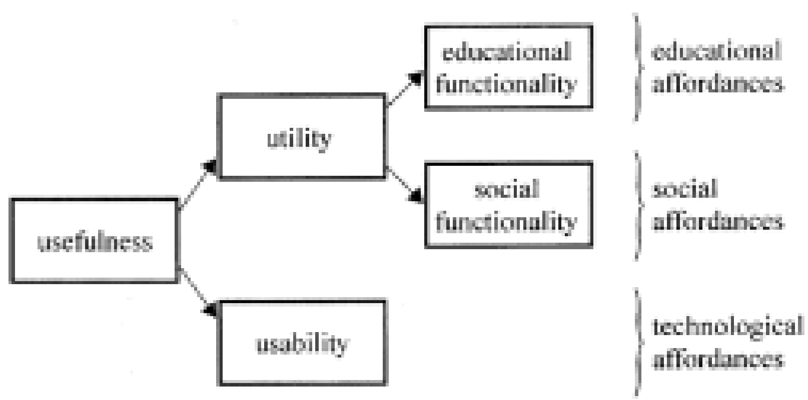


Figure 2 □ Usefulness is determined by various types of affordances.

5. Let's think about the process of our design and testing. How should we go about this?

Appendix D: Code Book Study 1

Student Info

First cycle: Attribute
Description: data about any student demographic issues
Inclusion: ethnicity, sex, age, schooling, language and level
Exclusion: site info

Levels

First cycle: Attribute
Description: examples that show the wide range of levels in classes
Inclusion: data showing language level and computer proficiency
Exclusion: site info

ELLs

First cycle: Subcoding; descriptive; attribute
Description: Any comments that refer to ELLs specifically
Inclusion: Comments about working with ELLs; and how it impacts teaching computer skills
Exclusion: Comments about learners in general

Class demographics

First cycle: Subcoding; descriptive; attribute
Description: Any data that describes WHO is coming or not coming to class
Inclusion: Any characteristics or attributes of students
Exclusion: Site info

Instruction of content

First cycle: Descriptive
Description: Any data that describes instructional issues.
Inclusion: Challenges, successes, synergies, resources, classroom logistics
Exclusion: Student info and teacher growth

Process of Instruction

Second cycle: Descriptive
Description: Teachers talk about process
Inclusion: Explicit descriptions of process
Exclusion: Descriptions of singular activities

Review

Second cycle: Descriptive
Description: Content review
Inclusion: Examples of content review and describing content review
Exclusion: Non-review activities

Using student home language

First cycle: Subcoding; descriptive
Description: Home language used in support of instruction
Inclusion: Data that explicitly and implicitly shows use of home language
Exclusion: Data about English language as medium for instruction

Articulation of skills

First cycle: Subcoding; descriptive
Description: All of the computer skills they mentioned teaching or I observed them teaching
Inclusion: Data from focus group discussion, class materials, and classroom observations
Exclusion: Data about activities employed to teach them

Classroom management

First cycle: Subcoding; descriptive
Description: management strategies employed
Inclusion: Data directly or implicitly showing management strategies
Exclusion: Descriptions of activities

Individual Help

First cycle: Subcoding; descriptive
Description: Teachers or volunteers providing one on one help
Inclusion: Interactions between student and helper
Exclusion: Whole class instruction

Cohort model

First cycle: Subcoding; descriptive
Description: Examples of cohort approach
Inclusion: Data showing preference or implementation of cohort model
Exclusion: Individualized instruction

Transferrable skills

First cycle: Subcoding; descriptive

Description: Data showing understanding about importance of teaching transferrable skills
Inclusion: Direct comments or evidence in examples
Exclusion: Talking directly about using content to teach a discrete skill

Display questions

First cycle: Descriptive
Description: Data including display questions
Inclusion: Field notes and transcription data about display questions
Exclusion: Other instructional strategies

Activity

First cycle: Subcoding; descriptive
Description: Descriptions of learning activities done in class
Inclusion: Examples of instructional activities regarding language and skills
Exclusion: Data from one to one help support

Resources

First cycle: Subcoding; descriptive
Description: Any comments that describe resources used or how they were selected
Inclusion: Examples of resources or description of their use; websites, worksheets, etc.
Exclusion: Instructional content

Use of Northstar

First cycle: Subcoding; descriptive
Description: Any comments about using NSDL assessments
Inclusion: Focus group conversation about assessment; examples of Northstar use in class
Exclusion: Instructional content

Language Analysis

First cycle: Structural
Description: Data important for study 3 regarding language or vocab
Inclusion: Data showing language use, data about vocabulary instruction
Exclusion: Data gathered about design

Conceptual understanding

First cycle: Subcoding; descriptive
Description: Data that shows that learning skills and vocab go hand in hand and that this conceptual understanding it is necessary if learners are to be able to transfer skills across contexts.

Inclusion: Data representing conversations about and classroom examples of
Exclusion: Data gathered about any particular word and basic meaning

Teaching Vocab

First cycle: Subcoding; descriptive
Description: Explicit vocabulary instruction
Inclusion: Talking about vocabulary instruction or doing it
Exclusion: Instruction that has no focus on vocabulary

Needs

First cycle: Structural
Description: Data important for study 1 re needs
Inclusion: Data gathered up to generation of the storyboard
Exclusion: Data gathered as design and use of iterations began

Multilingual

First cycle: Subcoding; attribute
Description: Any data pertaining to use of multilingual assets in design and instruction
Inclusion: Students using other languages, teachers using other languages, bilingual resources on the website
Exclusion: instructional data dealing with English language

Class logistics

First cycle: Subcoding; descriptive
Description: Comments that show how they set up programming and make decisions about when and where to hold class
Inclusion: Logistical information drawn from field notes and classroom observation
Exclusion: Design of the website

Differentiation

First cycle: Subcoding; descriptive
Description: Any teacher cues that show he/she allowing differentiation
Inclusion: How design can support differentiation; how instructional strategies either hinder or support differentiation
Exclusion: Resources

Appendix E: Code Book Study 2

Design phase

First cycle: Structural
Description: Data important for Study 2 regarding design
Inclusion: Data gathered as design and use of iterations began
Exclusion: Data that is explicitly about needs

Learner preference

First cycle: Subcoding; descriptive
Description: Data illustrating observed learner preference
Inclusion: Data touching on resources and web design
Exclusion: Failed design choices

Skills delimit design

First cycle: Descriptive
Description: Data that shows how skills and design go together
Inclusion: What they can and can't do
Exclusion: Resources and elements of site

Aesthetic preferences

First cycle: Descriptive; sub coding
Description: Comments that describe favored aesthetics
Inclusion: Color, style, page layout
Exclusion: Content or resources

Initial conjectures

First cycle: Subcoding; descriptive
Description: Initial ideas about what the design should be like, what it should accomplish, what might happen
Inclusion: My conjectures in my notes and any ideas from participants about how design will play out
Exclusion: Data that is explicitly about needs

Abandoned ideas

First cycle: Subcoding; descriptive
Description: Any ideas that came up and were abandoned during design phase (or even before it)
Inclusion: Any ideas that came up and were abandoned at some point during design phase

(or even before it)
Exclusion: Ideas that were acted upon and retained

First designs

First cycle: Subcoding; descriptive
Description: Descriptions of their first designs - could predate shift to design phase
Inclusion: Any descriptions of what they were doing at the start of the project
Exclusion: Descriptions of work, resources, strategies that were implemented after design and testing began

Appendix F: Digital Homeroom Linked Resources

Teaching digital literacy skills using digital technologies and web resources is a big challenge! Luckily, there are many resources available online. The Digital Homeroom links to resources compiled by AmeriCorps members providing instruction in community technology labs and classrooms. The links for these resources are shared below, structured so that you can see what skill they are intended to teach. If you have access to a copy of the website you can customize the links to better meet the needs of your learners. If not, use this document to help plan your instruction.
Use the rubric to determine the quality and suitability of the resource for your students and setting.

I. Homepages of deep linked resources.
Several sites offer rich curricula on a range of digital literacy skills. These are the 'parent' sites into which the Digital Homeroom deep links.
https://www.digitallearn.org/
http://www.gcflearnfree.org/
www.learningchocolate.com
http://mydigitalliteracy.us/
http://guides.sppl.org/northstar - specific resources that align with the Northstar Digital Literacy Assessment standards.

II. Deep links by skill area:
Computer Basics
Level: Beginner
Mousing
Read: http://www.gcflearnfree.org/mousetutorial/mouse-tutorial/1/
Watch & Listen: https://www.youtube.com/watch?v=_3s_OYgtl8g
Do: http://drag-n-drop.com/

Hardware
Read: http://www.gcflearnfree.org/computerbasics/basic-parts-of-a-computer/1/
Watch & Listen: https://www.youtube.com/watch?v=K00dKueUDuI
Do:
http://www.mndigital.dreamhosters.com/MIRC/BC_L2_Hardware_Software_DL/story.html

Keyboarding
Read: www.wikihow.com/type
Watch & Listen: https://www.youtube.com/watch?v=iedAF7sD6jk
Do: :http://www.learningchocolate.com/content/keys

Level: Intermediate

Desktop
Read: http://www.gcflearnfree.org/windows10/
Watch & Listen: https://www.youtube.com/watch?v=5smYx3enzbI
Do:
http://mndigital.dreamhosters.com/MIRC/BC_L3_Start_ShutDown_DL/story.html

Software
Read: http://www.computerhope.com/jargon/s/software.htm
Do:http://www.mndigital.dreamhosters.com/MIRC/BC_L2_Hardware_Software_DL/story.html
Watch & Listen
https://www.google.com/url?q=https://www.youtube.com/watch?v%3Dk-EID5_2D9U&sa=D&ust=1486418193981000&usg=AFQjCNECvAlPHKOwjRYTN8j8d355bIVwcA

File Management
Read: http://www.gcflearnfree.org/basic-computer-skills/understanding-file-extensions/1/Watch & Listen
https://www.youtube.com/watch?v=ueoOvrGC3rg
Do: https://www.digitallearn.org/courses/using-a-pc-windows-10

Level: Advanced

Search Options
Read:
http://www.quepublishing.com/articles/article.aspx?p=1393064&seqNum=15
Watch & Listen:
https://www.bing.com/videos/search?q=how+to+use+the+search+options+on+windows&&view=detail&mid=80F6E2E1E2250AA4E36280F6E2E1E2250AA4E362&rvsmid=83116AB99006A79C29F183116AB99006A79C29F1&fsscr=0&FORM=VDFSRV
Do: http://www.gcflearnfree.org/windows10/getting-started-with-windows-10/1/

Control Panel
Read: http://www.gcflearnfree.org/windows10/personalizing-your-desktop/1/
Watch Listen:
https://www.bing.com/videos/search?q=windows+control+panel&&view=detail&mid=C2F36AA28A2BED7B2EBEC2F36AA28A2BED7B2EBE&FORM=VRDGAR
Do:https://www.youtube.com/watch?v=rx7krqUx5E4

Settings
Read: http://www.gcflearnfree.org/windowsbasics/adjusting-your-settings/1/
Watch & Listen: http://www.isunshare.com/windows-8/go-to-pc-settings-in-windows-8.html
Do: http://www.gcflearnfree.org/windowsbasics/quiz

Microsoft Word
Level: Beginner
Opening and Saving Documents
Read: http://www.gcflearnfree.org/word2013/creating-and-opening-documents/1/
Watch & Listen: https://www.digitallearn.org/courses/microsoft-word/lessons/introduction-cb8925aa-693e-4a82-82e4-f0c339fccad4
Do: https://support.office.com/en-us/article/The-first-time-you-open-Word-74052bd9-8335-40d1-b8c4-897cee4a8c08

Text Basics
Read: http://www.gcflearnfree.org/word2013/text-basics/1/
Watch & Listen: https://www.digitallearn.org/courses/microsoft-word/lessons/fromatting
Do: https://support.office.com/en-us/article/Just-start-typing-b7125294-b5c4-4ede-ba7f-10e9d5455230

Printing Documents
Read: https://www.gcflearnfree.org/word2013/printing-documents/1/&sa=D&ust=1486418193982000&usg=AFQjCNF-ZTuTc-Gz8xYDkviYzVylI2t5BQ

Watch & Listen: https://www.youtube.com/watch?v=gyZYbMlXGkc
Do: https://support.office.com/en-us/article/Save-print-and-close-your-document-7022228e-d336-4e6d-bb32-8557f10c38f7

Level: Intermediate
Undo/Redo
Read: http://www.dummies.com/software/microsoft-office/word/how-to-use-undo-and-redo-in-word-2007/
Watch & Listen: https://www.youtube.com/watch?v=gH3BOsonfoo
Do: http://www.gcflearnfree.org/basic-computer-skills/undo-your-mistakes/1/

Cut, copy, paste
Read: http://www.gcflearnfree.org/word2013/text-basics/2/
Watch & Listen https://www.youtube.com/watch?v=ufsUzFhefv8

Do: http://www.homeandlearn.co.uk/MW/s3p1.html

Page Layout
Read: (empty now)
Watch & Listen: https://www.youtube.com/watch?v=WpsemgS-F5c
Do: http://www.gcflearnfree.org/word2016/page-layout/1/

Level: Advanced
Insert tab
Read: http://campusguides.lib.utah.edu/c.php?g=160452&p=1051557
Watch & Listen: https://www.youtube.com/watch?v=Ot0aUeUfozw
Do: https://wikis.engrade.com/inserttabribbon

Review tab
Read: http://www.learningcomputer.com/ms_word_review_tab/
Watch & Listen: https://www.youtube.com/watch?v=ZWf0iIIYBfc
Do: http://www.geoff-hart.com/resources/Using-revision-tracking.pdf

Skills/Tasks Resume formatting
Watch & Listen: https://www.youtube.com/watch?v=Z1ccyPmLHj
Do: http://www.wikihow.com/Create-a-Resume-in-Microsoft-Word
Read: http://uncw.edu/career/documents/mswordformattingtips.pdf

Internet
Level: Beginner
What is the internet?
Read: http://www.gcflearnfree.org/internetbasics/what-is-the-internet/1/
Watch & Listen: https://www.youtube.com/watch?v=J8hzJxb0rpc
Do: http://www.bbc.co.uk/guides/zgqfyrd#zqsk87h

Navigation, browsers, websites
Read: http://www.gcflearnfree.org/internetbasics/using-a-web-browser/1/
Watch & Listen: https://www.youtube.com/watch?v=FxirRVJWUTs
Do: https://www.digitallearn.org/courses/navigating-a-website/lessons/introduction-87a299c6-d872-490c-9673-bdd44a05f416

Level: Intermediate
Effectively using search engines
Read: http://www.gcflearnfree.org/searchbetter/all-about-online-search/2/
Watch & Listen: https://www.youtube.com/watch?v=lnoeXTY1Zlo
Do: https://www.digitallearn.org/courses/basic-search

Browser elements
Read: http://www.bbc.co.uk/webwise/topics/using-the-web/using-a-browser
Watch & Listen: https://googleblog.blogspot.com/2009/10/what-is-browser.html
Do: http://www.gcflearnfree.org/chrome/quiz

URL & Address Bar
Read: http://www.gcflearnfree.org/internetbasics/understanding-urls/1/
Watch & Listen: https://www.youtube.com/watch?v=d15SBe3diu4
Do: http://study.com/academy/lesson/what-is-a-url-definition-examples-quiz.html

Level: Advanced
Internet Safety and Security
Read:
http://programs.online.utica.edu/articles/TenWaysToProtectYourIdentity
http://www.bbc.co.uk/webwise/0/22717888 or
http://www.bbc.co.uk/webwise/0/22717881
Watch & Listen: http://www.gcflearnfree.org/internetsafety/
Do: https://www.digitallearn.org/courses/online-scams

Captcha
Read: http://computer.howstuffworks.com/captcha.htm
Watch & Listen: https://www.youtube.com/watch?v=XD9Auc5cS5s
Do: https://www.sporcle.com/games/tyder21/captcha-blitz

Bookmarks
Read: http://www.gcflearnfree.org/chrome/bookmarking-in-chrome/1/
Watch & Listen: http://www.gcflearnfree.org/chrome/bookmarking-in-chrome/1/
Do: http://www.w2tw.uk/4551.htm (Only one question in a longer quiz, and asks that users bookmark the actual page)

Email
Level: Beginner
Creating an email account
Read:https://www.gcflearnfree.org/print/gmail/setting-up-a-gmail-account?playlist=Gmail
Watch & Listen: https://www.youtube.com/watch?v=cfO_iRv9Jro
Do: https://www.digitallearn.org/courses/intro-to-email

Writing and sending an Email

Read: http://www.gcflearnfree.org/email101
Watch & Listen:
https://www.youtube.com/watch?v=kQUp2kc8_TM
Do: http://www.learningchocolate.com/content/email

Proper Email Form
Read: http://www.gcflearnfree.org/email101/how-formal-should-an-email-be/1/
Watch & Listen: https://www.youtube.com/watch?v=JvvDTuosJyY
Do:
https://my.northcoast.tafensw.edu.au/thedepot/Public%20Files/Getting%20Out%20There%20Final/email/email-activity.htm

Level: Intermediate
Sending attachments
Read: http://www.computerhope.com/issues/ch000887.htm
Watch & Listen:
https://www.digitallearn.org/courses/intro-to-email-2-beyond-the-basics/lessons/working-with-attachments
Do: http://www.gcflearnfree.org/email101/email-etiquette-and-safety/2/

Reply v. Reply All
Read: https://www.netmanners.com/989/proper-use-of-reply-to-all/
Watch & Listen: https://www.youtube.com/watch?v=cIs3QgpDdU8
http://video.newyorker.com/watch/shorts-murmurs-what-reply-all-emails-feel-like
Do: https://blog.hubspot.com/sales/reply-reply-all-bcc-flowchart#sm.0000wpogvf7xddiyyss1iyqgc8d17 (Not interactive & Pop-ups)

Trash
Read: https://www.systoolsgroup.com/gmail-backup/deleted-email-recovery.html
Watch & Listen: https://www.youtube.com/watch?v=eAr_yAJGyaY
Do: https://support.google.com/inbox/answer/6067580?hl=en (Not interactive)

Level: Advanced
Spam
Read: https://emailmarketing.comm100.com/email-marketing-ebook/email-spam.aspx
Watch & Listen: https://www.youtube.com/watch?v=apCdjFIacfU
Do: https://www.sonicwall.com/phishing/phishing-quiz-question.aspx

Email Safety.
Read: http://www.gcflearnfree.org/email101/email-etiquette-and-safety/4/
Watch & Listen: https://www.youtube.com/watch?v=vrsPkegMASY
Do: https://www.thinkuknow.co.uk/8_10/games/emailquiz/

Email Signature
Read:
https://support.google.com/mail/answer/8395?co=GENIE.Platform%3DDesktop&hl=en
Watch & Listen: https://www.youtube.com/watch?v=tgbdTzxHJp8
Do: https://www.hubspot.com/email-signature-generator

III. Other useful resources not linked to below.

www.typing.com/typinglessons
www.typingclub.com/lesson33
http://www.pbclibrary.org/mousing/mousercise.htm
http://drag-n-drop.com/

Appendix G: Online Resource Evaluation Rubric

Use this rubric to help you decide whether or not an online resource will work with your learners. It is based on past TAC member experience and two popular sources: 1) the Achieve.org OER evaluation rubric and Tomlinson, 1988 (as recorded by Ciaffaroni, 2006). Copy the rubric and edit to fit your instructional needs.

	3- superior	2- strong	1- limited	0- weak	N/A
Alignment to Northstar Digital Literacy standards					
Quality of content explanations					
Utility for instruction					
Culturally relevant/not exclusive or bounded					
Quality of exercise & activities					
Opportunities for deeper learning; student can follow their interest/ opportunities for driving their own learning (self-discovery)					
Comprehensible input/learners can understand instructions and explanations					
Learning styles; differences accounted for					
Supports affective engagement; ample reward and signals of success					
Appropriate level of technological interactivity for learners					
Visual impact; triggers learner curiosity and interest					

Layout; ease of navigation and supports learning					
Accessibility (see the Achieve Accessibility Rubric)					

Evaluation Resources

Achieve Accessibility Rubric
Use the rubric to assure materials are accessible to all students," including students identified as blind, visually impaired or print disabled". The rubric can help you determine the degree to which the materials are accessible to a wide range of learners.

Achieve's Rubrics for Evaluating Open Education Resource (OER) Objects
Read more about Achieve's OER rubric categories

Rubric I. Degree of Alignment to Standards
Rubric II. Quality of Explanation of the Subject Matter
Rubric III. Utility of Materials Designed to Support Teaching
Rubric IV. Quality of Assessment
Rubric V. Quality of Technological Interactivity
Rubric VI. Quality of Instructional and Practice Exercises
Rubric VII. Opportunities for Deeper Learning Rubric VIII. Assurance of Accessibility

Tomlinson's Self-Access Materials
Read more about how to evaluate self-access learning materials.
Tomlinson, B. (1998). Self-access materials. In B. Tomlinson (ed.), Materials Development in Language Teaching, 320-336. Cambridge: CUP.

Relevant text quoted from Ciaffaroni (2006, pp 4-5)**:**

> *Impact*
> *With ESL/EFL websites meant for self-study, the materials and activities they contain should achieve impact in the first place. According to Tomlinson (1998b) "impact is achieved when materials have a noticeable effect on learners, that is, when learners' curiosity interest and attention is attracted". Impact might be created by different factors, the main one being choice.*
>
> *Affective engagement*
> *As well as achieving impact, the materials and the activities in a website ought to involve the learners affectively. In fact, according to the affective engagement*

principle, foreign language is more easily acquired if learners feel relaxed, confident and successful and if they are able to respond to the target language holistically, with their whole beings (Tomlinson, 1998c).

Maximization of the brain's learning potential
The materials and the activities in a website should stimulate the learners to use both their previous experience and their left and right brain. This principle from Suggestopedia (Lozanov, 1978) states that language acquisition is enhanced when the input materials are stimulating and the learning activities are not too simple, so that the learners need to use their previous experience and both their left and right brain to complete them

Comprehensible input
Since ESL/EFL websites are virtual self-access centres, with little or no support from teachers, they should provide comprehensible input. Krashen (1985) first elaborated the idea of comprehensible input of a slightly higher level than the learner's. As well as being comprehensible, input needs to be as challenging and as varied as possible, in order to trigger the learners' interest. Thus, selection of input is a key factor for SLA, which needs to be properly reflected in self-access materials.

Self-discovery
An ESL/EFL website needs to be particularly suitable for the learners to invest effort and attention in their learning activity. This principle, explored by many researchers (see, e.g., Ellis, 1990 or Bolitho and Tomlinson, 1995) maintains that learning materials and activities should help the learners to make informed decisions and self-discoveries.

Learning styles
As ESL/EFL websites are meant for the general learners, they should consider that users might have different learning styles. Thus, the activities and the materials they provide should cater not only for the analytic but also for the reflective and experiential learners and take into account the kinesthetic as well as the auditory and visual learning styles (Ellis, 1990; Oxford, 1990).

Layout specifications
As well as responding to SLA principles an EFL/ESL website should maximise learner ease of use through a series of devices, such as

- *Functional layout*
- *Clear instructions*
- *Easily retrievable activities*

• *Teacher support*
• *Opportunities for interaction*

Appendix H: Code Book Study 3

Student Info

First cycle: Attribute
Description: data about any student demographic issues
Inclusion: ethnicity, sex, age, schooling, language and level
Exclusion: site info

Levels

First cycle: Attribute
Description: examples that show the wide range of levels in classes
Inclusion: data showing language level and computer proficiency
Exclusion: site info

ELLs

First cycle: Subcoding; descriptive; attribute
Description: Any comments that refer to ELLs specifically
Inclusion: Comments about working with ELLs; and how it impacts teaching computer skills
Exclusion: Comments about learners in general

Class demographics

First cycle: Subcoding; descriptive; attribute
Description: Any data that describes WHO is coming or not coming to class
Inclusion: Any characteristics or attributes of students
Exclusion: Site info

Instruction of content

First cycle: Descriptive
Description: Any data that describes instructional issues.
Inclusion: Challenges, successes, synergies, resources, classroom logistics
Exclusion: Student info and teacher growth

Process of Instruction

Second cycle: Descriptive
Description: Teachers talk about process
Inclusion: Explicit descriptions of process
Exclusion: Descriptions of singular activities

Review

Second cycle: Descriptive
Description: Content review

Inclusion: Examples of content review and describing content review
Exclusion: Non-review activities

Using student home language

First cycle: Subcoding; descriptive
Description: Home language used in support of instruction
Inclusion: Data that explicitly and implicitly shows use of home language
Exclusion: Data about English language as medium for instruction

Articulation of skills

First cycle: Subcoding; descriptive
Description: All of the computer skills they mentioned teaching or I observed them teaching
Inclusion: Data from focus group discussion, class materials, and classroom observations
Exclusion: Data about activities employed to teach them

Classroom management

First cycle: Subcoding; descriptive
Description: management strategies employed
Inclusion: Data directly or implicitly showing management strategies
Exclusion: Descriptions of activities

Individual Help

First cycle: Subcoding; descriptive
Description: Teachers or volunteers providing one on one help
Inclusion: Interactions between student and helper
Exclusion: Whole class instruction

Cohort model

First cycle: Subcoding; descriptive
Description: Examples of cohort approach
Inclusion: Data showing preference or implementation of cohort model
Exclusion: Individualized instruction

Transferrable skills

First cycle: Subcoding; descriptive
Description: Data showing understanding about importance of teaching transferrable skills
Inclusion: Direct comments or evidence in examples
Exclusion: Talking directly about using content to teach a discrete skill

Display questions

First cycle: Descriptive

Description: Data including display questions
Inclusion: Field notes and transcription data about display questions
Exclusion: Other instructional strategies

Activity

First cycle: Subcoding; descriptive
Description: Descriptions of learning activities done in class
Inclusion: Examples of instructional activities regarding language and skills
Exclusion: Data from one to one help support

Resources

First cycle: Subcoding; descriptive
Description: Any comments that describe resources used or how they were selected
Inclusion: Examples of resources or description of their use; websites, worksheets, etc.
Exclusion: Instructional content

Use of Northstar

First cycle: Subcoding; descriptive
Description: Any comments about using NSDL assessments
Inclusion: Focus group conversation about assessment; examples of Northstar use in class
Exclusion: Instructional content

Language Analysis

First cycle: Structural
Description: Data important for study 3 re language or vocab
Inclusion: Data showing language use, data about vocabulary instruction
Exclusion: Data gathered about design

Conceptual understanding

First cycle: Subcoding; descriptive
Description: Data that shows that learning skills and vocab go hand in hand and that this conceptual understanding it is necessary if learners are to be able to transfer skills across contexts.
Inclusion: Data representing conversations about and classroom examples of
Exclusion: Data gathered about any particular word and basic meaning

Teaching Vocab

First cycle: Subcoding; descriptive
Description: Explicit vocabulary instruction
Inclusion: Talking about vocabulary instruction or doing it
Exclusion: Instruction that has no focus on vocabulary

Needs

First cycle: Structural
Description: Data important for study 1 re needs
Inclusion: Data gathered up to generation of the storyboard
Exclusion: Data gathered as design and use of iterations began

Multilingual

First cycle: Subcoding; attribute
Description: Any data pertaining to use of multilingual assets in design and instruction
Inclusion: Students using other languages, teachers using other languages, bilingual resources on the website
Exclusion: instructional data dealing with English language

Class logistics

First cycle: Subcoding; descriptive
Description: Comments that show how they set up programming and make decisions about when and where to hold class
Inclusion: Logistical information drawn from field notes and classroom observation
Exclusion: Design of the website

Differentiation

First cycle: Subcoding; descriptive
Description: Any teacher cues that show he/she allowing differentiation
Inclusion: How design can support differentiation; how instructional strategies either hinder or support differentiation
Exclusion: Resources

Appendix I: Alignment of Northstar Digital Literacy Assessment Standards and Erik's Course Materials

Computer Basics Terminology	
Northstar Digital Literacy Assessment Standards	**Articulated or related terms in Erik's materials**
Distinguish between desktop and laptop computers.	Laptop
Identify specific computer hardware: a system unit, monitor, printer, keyboard, mouse or touchpad, USB port	Printer, mouse, port, system unit, monitor, USB port, keyboard, Ethernet
Turn computer and monitor on and off	Turn on computer
Log on to computer	Log on
Demonstrate knowledge of function and placement of keys on keyboard: Enter, Shift, Control, Backspace, Delete, Arrow Keys, Tab, Caps Lock, Number Lock	Tab, caps loc, shift, ctrl, spacebar, enter, backspace, delete
Identify types of mice: mouse and touchpad	Mouse
Identify mouse pointer shapes and match them to the correct context of use: typing arrow (text), arrow (basic clicking), hand pointer (clickable links)	Typing cursor, arrow, basic cursor, open links, loading
Demonstrate appropriate use and ability to right-click and left-click	More information
Double click and right click	Double Click to Open Programs
Drag and drop	Click and drag*
Use mouse to select check boxes, use drop-down menus and scroll	Scroll
Adjust volume and mute audio	Turn up volume
Plug in headphones correctly and use when appropriate	Headphone Jack
Identify icons on desktop (Internet Browser, Control Panel, Recycle Bin, Skype)	Icons, maximize, minimize, start menu, taskbar, close, shut down

Demonstrate the ability to use the recycle bin correctly for trashing and retrieving items	
Demonstrate understanding that it is possible to customize a computer for increased accessibility	
Demonstrate understanding that mice can be customized for left-handed people and that the speed of clicking can also be customized	
Demonstrate understanding that screen resolution can be changed	
Demonstrate understanding that software programs are upgraded periodically and that different versions may be installed on different computers	
Identify storage media: USB/Flash drives (external) and hard drive (external and internal)	

Computer Basics Terminology	
Northstar Standards	**Terms in Erik's Materials**
Align text: left, center and right justify	Alignment, center, left, right
Use bullets and automatic numbering	Bullets, numbering
Save and close a document	Close is in computer basics
Cut, copy and paste	Cut copy paste
Use Save As to save to a particular folder or file location and name the document.	File
Format the size, color and type of font	Font size, font style, font color, bold* italics*, underline*
Set single or double spacing	Line spacing
Set margins	Margins
Select portrait or landscape	Orientation; page layout
Identify ribbon and toolbars	Ribbon, review
Demonstrate knowledge of the difference between "Save" and "Save As" functions.	Save as, save
Use spell check and grammar check	Spelling, grammar,
Use undo and redo arrows	Undo, redo

Create a new document	
Open existing document	
Use print preview and print.	
Identify file extensions, corresponding document types and associated programs used to open them: pdf, xls, doc, docx, rtf, pub, ppt, pptx	
	Translate language
	Insert
	Pictures
	Online pictures
	Shapes
*Topically related. Explicitly stated in Excel	